Draft Interim Plan
Habitat Protection and Enhancement
Frog Pond Wetland Preserve
Del Rey Oaks, Monterey County, California

Prepared for and in Consultation with:
Tim Jensen
Planning and Conservation Manager
Monterey Peninsula Regional Park District

Prepared by:
Balance Hydrologics, Inc.
Zander Associates, Inc

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A report prepared for:

Monterey Peninsula Regional Park District
Tim Jensen, Planning & Conservation Manager
60 Garden Court #325
Monterey, California 93940
(831) 647-7795

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By:

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Zander Associates Project No. _____

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Barry Hecht, Principal

Balance Hydrologics, Inc.
900 Modoc Street
Berkeley, California 94707-2208
(510) 527-0727
bhecht@balancehydro.com

____
Leslie Zander, Principal

Zander Associates
150 Ford Way, Ste. 101
Novato, CA 94945
(415) 897-8781

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1. INTRODUCTION

Monterey Peninsula Regional Preserve District has owned the Frog Pond Wetland Preserve in Del Ray Oaks since 1977. The Preserve is an important natural area at the western end of the Highway 68/218 corridor between Monterey and Salinas. The 17-acre Preserve is largely bottomland and gently sloping hillsides surrounding a central pond. The Park District seeks to manage this area with wetland and habitat uses preeminent. The Zander/Balance team was chosen to develop unifying concepts and constrains and opportunities, and to make suggestions regarding the steps and vehicles needed to complete a management and interpretative plan for this site.

The Preserve is located near the eastern edge of the City of Del Rey Oaks, near the southwestern corner of the former Fort Ord military reservation. It is bounded on the south by State Highway 218, on the east by General Jim Moore Blvd, on the west by the backyards of homes of Carlton Drive, built atop a low bluff, and on the north and northeast by chaparral-covered hillslopes leading up into other residential areas. Arroyo del Rey, a formerly-intermittent stream with a generally-sandy 13.5 square-mile watershed, flows immediately south of Highway 218, channelized against the hills to the south, flowing toward Laguna Grande del Rey, a major freshwater coastal lagoon approximately a mile to the northwest.

Runoff into the Preserve is primarily from the southeast, where a remnant of floodplain drains former Fort Ord lands into the Frog Pond Preserve. A steep-walled arroyo drains into the northeastern corner of the Preserve through a culvert beneath Jim Moore Blvd; with a topographic (and potential sediment-producing) watershed of about 2 square miles, this catchment is a potential major source of sediment and urban runoff. Smaller local drainages from adjacent residential catchments, highway 218 drainage from the west, and transported sediments from commercial developments in upper reaches of Arroyo del Rey are other locally-significant inflows. The depressed Frog Pond Preserve area itself holds water to a depth of a few feet. It overflows during periods of high runoff through a surface weir installed by The Park District to retain water for habitat purposes before re-entering Arroyo del Rey. Water levels in the pond are controlled by a weir and cobblestone bed beneath an existing footbridge at the Preserves northwest entrance. Inflows originate from Arroyo del Rey overflow, springs below Carlton Avenue, and minor overflows from former Fort Ord, which are mostly trapped behind Jim Moore Blvd. These and related water-quality sources are shown schematically in Figure 3.

The Preserve is part of the Seaside Ground-Water Basin, managed with increasing intensity for water supply. The regional ground-water levels are well below the Pond, and we do not believe that the regional water table supports the wetlands. Rather, shallow ground water from within the Preserve boundaries may be perched on the fine-grained sediment underlying the Preserve and its surroundings. This shallow zone may be better seen as an underground extension of the pond rather a true 'source' of water.

The Park District plans to use this site primarily for its wetland and habitat functions. The pond and surrounding Preserve are in close proximity to several important valley-edge and upland habitats; hence, the diverse vegetative mosaic may be preserved and observed at the site. The pond is currently receiving urban runoff from adjoining roadways but there are substantial commercial developments proposed in the vicinity on former Fort Ord lands which may impact both water quality and quantity at the Preserve. Continued upstream development within the watershed may also have an impact on Arroyo del Rey water quality and quantity. Increased runoff and particularly sediment delivery from these areas could significantly alter the depth and capacity, hydrologic functions and processes of the pond and its fringe.

2. THE FROG POND – A DROWNED VALLEY REMNANT

The pond is the southernmost of the drowned tributary valleys which characterized the pre-development sandhills of eastern Monterey Bay area (HEA, 1984; U.S.D.A. Task Force, 1984). The sandy soils are so pervious that under natural conditions little runoff was generated by even the largest of storms. Many of these watersheds were unable to produce sufficient sediment to fill their valleys as sea level rose from its lowest levels during the maximum late-Pleistocene glaciations approximately 18,000 years ago. The low-yield valleys gradually became impounded as the larger through-flowing streams or coastal plains accumulated fresh sediment, leaving behind freshwater lagoons or seasonal wetlands. The type locality for these left-behind valleys is Garin Lake, between Pajaro and Elkhorn Slough; they are sometimes called Garin Lake ponds. Other examples include Pinto Lake, Harkins Slough, Ellicott Pond, Valencia

Lagoon, College Lake, and Meritt and Espinosa Lakes, among others. Partially-endemic vegetation, reptiles and amphibians evolved as these lakes developed.

Although much younger and formed by very different processes, the drowned-valley wetlands share some biologic and hydrologic affinities with vernal pools, and are ecologically at least as interesting. The drowned-valley ponds are usually seasonal, often drying in the summer months. They also helped support the plentiful waterfowl and avifauna which lent their name to the Pajaro River and Valley; the visually-striking salty seasonal ponds ('salinas') may also have contributed to naming of the town, valley and river. Some of the plant species are common to the drowned valley ponds and vernal pools, and they both support diverse hydrophytic species, often with multiple species from the same genus[1]. Sediment entering either type of wetland tends to remain, as there is little opportunity to remobilize and transport sand or silt from either type of depressional wetland. The two types of wetlands also share a common vulnerability to contamination – pollutants entering these wetlands tend to remain within them, especially those constituents which are adsorbed to sediment or organic matter.

In conjunction with the Park District's proposed use of the pond as a preserve focused on wetlands and wildlife, the pond's status as a remnant of the unique drowned valleys of eastern Monterey Bay offers an important potential unifying theme which can help shape the educational and restoration elements of the Preserve's eventual plan, should Park District staff so wish.

Retaining the Frog Pond as the drowned-valley remnant, however, requires an environment in which sedimentation is minimized. The very manner in which the drowned-valley wetlands formed required a tributary with very low sediment yields and a main stem with higher yields. Hence, every effort should be made to reduce sediment delivery to the Frog Pond. The next section of this report identifies the constituents of concern and describes an integrated approach to controlling both sedimentation and water quality.

[1] C.f., *Eleocharis*, from which at least five species are reported from the drowned-valley ponds.

3. GOALS AND STRATEGIES FOR MANAGING SEDIMENTATION AND WATER QUALITY AT FROG POND PARK DISTRICT PRESERVE

This chapter considers the water-quality functions of the drowned-valley wetlands, and the goals and strategies that might be used to retain these functions as well as protect the habitat of California Red-Legged Frog and other endemic or indicator species that may exist in the Preserve.

3.1 Drowned-valley wetlands as natural water-quality systems

Drowned-valley wetlands have several well-developed or unusual attributes which shape the functions they impart to sedimentation and water quality.

- **Depressional Wetland** – Unlike most wetlands, the Frog Pond is a depression, and shares many attributes with the limited number of other depressional wetlands, such as vernal pools and plays. Among these is the long residence time that may be expected for any sediment or contaminants entering the wetland. Neither particulates nor toxins are readily flushed out of a drowned-valley wetland.

- **Fine Grained** – The floors of such wetlands are fine-grained, capable of perching water for days or months before it evaporates or percolates to ground water. Fine-grained substrate helps transform, reduce to mineral form, or sequester many contaminants, limiting their mobility.

- **High Organic Content** – Also capable of adsorbing contaminants, the high organic content is rare in the sandy soils of the eastern Monterey Bay area. Finely-divided organic matter helps degrade and transform most synthetic organic chemicals entering the Preserve from urban and road runoff.

- **Resilience** – Drowned-valley wetlands can be resilient in their functions if they are not filled or contaminated to a severe degree. Among prominent examples drowned-valley wetlands which remain viable and functional in challenging environments are Bixby and Dominguez Sloughs north of Long Beach, Harkins and Struve Sloughs near Watsonville, and Warden and Eto Lakes near Morro Bay. Alternating wetting and drying is likely an important factor in reducing or transforming contaminants entering these wetlands, and one likely to continue so long as the wetland is not sedimented or otherwise filled.

- **Susceptibility** – In addition to the persistent effects of contaminants that may enter the depression, drowned-valley wetlands can sustain long-term damage when sediment or contaminants from the much-larger mainstem channel enter the wetland at the mouth of a side valley.

3.2 Water-quality goals and objectives

Water entering the Frog Pond Wetland Preserve from all sources other than rainfall will contain small proportions of the chemicals considered to be of concern (see Sec. 3.3). A useful goal will be to reduce concentrations entering the Frog Pond itself to below thresholds recently identified for frog survival. To do so will require a variety of treatments, all of which must be consistent with needs of other Preserve resources. In summary, water-quality must be suitable for survival of red-legged frogs from incubation through metamorphosis, yet also reflect the quality likely to be encountered in a little-disturbed drowned-valley wetland.

3.3 Constituents of concern

Sediment may be the single dominant constituent of concern. Deposition of sediment can change the wetland area surrounding the Frog Pond. Medium and coarse sands are of main concern. The volume of sediment deposited annually should be minimized through source control.

Trace elements – Trace metals and other elements are likely to have adverse effects on amphibians and their sources. These constituents enter the Preserve from urban and highway runoff; naturally-occurring trace metals are present in potentially-problematic levels in stream sediments and waters, mobilized from the Monterey formation (Majmundar, 1980).

Nutrients – Nitrates and phosphates originate primarily from fertilizers, urban runoff, and wildlife sources. Elevated concentrations of phosphate are also common in streams originating from the Monterey formation and other diatomaceous shales in the watershed. Nitrates are usually present at concentrations below 3 to 5 mg/L as N, below the threshold of 8 to 10 mg/L likely to be associated with nitrite concentrations found problematic for certain frogs (Marco and

Blaustein). Increasingly, herpetologists working in California are finding algal scums and periphyton to be locally beneficial, providing shelter and cover.

Pesticides -- Both urban and agricultural pesticides are used in the Arroyo del Rey watershed, and may appear in water or sediment during storms. Of particular concern is the regular annual treatment of the pond for mosquitoes by the Northern Salinas Valley Mosquito Abatement District. The District uses both chemical insecticides and oil. The Recovery Plan for red-legged frogs notes that minimal information is available for frogs' chemical tolerances.

Oils and grease – Oils from both roadways and from eucalyptus and other alelopathic plants, in addition to the aforementioned mosquito abatement district use, are potentially deleterious to the frogs and the long-term biodiversity of the pond and down stream habitat.

3.4 Control strategies

Appropriate water-quality strategies and measures meeting these goals and addressing the constituents include:

- **Source control** – Control of sources is crucial at both the site and watershed scale if sedimentation is to be minimized and modulated during periods of episodic sediment delivery. The site scale includes both minimizing new sources at the edge of the Preserve and on nearby public and private Preserve and roadways, particularly those that may incise and deliver a large prism of material. At the watershed scale, minimizing gullying of hillsides or colluvial wedges and flats within the Arroyo del Rey watershed as well as incision of its channel and major tributaries will benefit not only the Frog Pond but also Laguna del Rey and other wetlands upstream of the Preserve along Highway 68 and in the foothills to the south; related efforts are already under way as part of conditions of approval for individual projects.

- **Sedimentation and filtration –** Within the Preserve, sediment should be retained as far away as possible from the Frog Pond itself, and as close to the point of entry into the reserve as possible. Most sedimentation can be intercepted before entering the pond with a combined program of (a) small catch basins or forebays periodically emptied, (b) settling basins to retain silt and very fine sand, and (c) filtration through grasses and emergent perennials (such as rushes, sedges, or cattails). A treatment series (or "treatment train") of this type is proposed in the next chapter. Some clays and finely-divided organic matter should pass through this series of treatments, replenishing material oxidized or blown from the bed of the Frog Pond.

- **Spill Capture** – To the extent feasible, forebays or small basins at the main points where flows enter the Preserve will help retain spilled compounds before they are dispersed throughout the reserve.

- **Ponding** – Denitrification plus other decays and transformations will occur in shallow ponded water, especially in the presence of abundant organic matter and fine silts and clays.

- **Maintaining Inflow** - Regular inflow of leaves and finely-divided organic particulates helps to replace organic matter lost annually to oxidation while providing reactive surfaces upon which decay and adsorption of contaminants can occur. Many contaminants simply bind to fine organic matter, where they remain fixed in place to degrade or transform over time.

- **Communicating** – Imparting to the using public that the wetland and the frogs it supports are important, susceptible, and nearly-irreplaceable resources, will help promote understandings and partnerships especially with FORA, Caltrans and some of the other larger neighboring entities (see Sec. 4.2, Dialog).

4. PLAN ELEMENTS AND ALTERNATIVES

Several elements and alternatives addressing the water-quality goals for this wetland can be identified.

4.1 Education and communication

A key element in promoting water quality suitable for protecting the habitat and ecological-heritage goals for the site is communicating its values to the individuals and entities near and surrounding the Frog Pond. Education can best address six separate concepts:

- California red-legged frogs use the pond and surrounding hillslopes for all life stages; the pond is an ideal environment for CRLF with all needed habitats present within the Preserve boundaries

- Red-legged frogs and other amphibians are vulnerable to contaminants, especially trace metals and pesticides, which a number of knowledgeable scientists believe to be responsible for declines in amphibian populations world-wide.

- Pollutants that enter the Frog Pond are likely to remain – and adversely affect frogs – for many years, since there is little movement of chemicals out of the pond.

- Frog Pond Wetland Preserve is a reasonably intact drowned-valley wetland, an unusual type of wetland related to the global rise of sea level following the most recent ice age, and in California, best developed in the Monterey Bay area, and part of the region's ecological heritage. Since it took 10,000 to 15,000 years to develop the wetland, its potential loss to sedimentation or contamination might be considered near-irreplaceable.

- If the Frog Pond is filled with sand, it is likely that the limited water available during summer will not be accessible to tadpoles or metamorphs because it will be filling the pores between the sand grains rather than ponding at the surface.

- Water-quality protection is needed to both reduce contaminants from (a) the area immediately surrounding the pond, within the watersheds tributary to the pond, and (b) perhaps equally or even more, from Highway 218 and Arroyo Del Rey.

4.2 Dialog

Given the difficulty of removing contaminants from the Frog Pond, it may prove desirable to enter into dialog with four agencies:

Caltrans: State Route 218 runs along the southern boundary of the Preserve. Caltrans should be made aware of the potential damage to the Frog Pond that road runoff, an accident or spill, or simply placement of fill during emergencies. At present, the Frog Pond is one of very few locations along this section of the highway where material removed from the roadway during an emergency may be temporarily stored. It is easy to envision a circumstance in which Caltrans seeks to remove a threat to the highway, such as might result from blockage of Arroyo del Rey by a landslide or by aggradation of several feet during the first storms following a large wildfire upstream. The Park District may wish to work with Caltrans to arrange for an alternate site for emergency or temporary storage to minimize effects on the pond or red-legged frogs. Caltrans should be made aware of the danger to both habitat and frogs of pesticide, petroleum-product or other SOC spills, and may enter this information into its contingency plans or its GIS system. Measures to minimize highway runoff directly into the Preserve should also be sought.

Del Rey Oaks Public Works Department: Management of road runoff and development adjacent to and in surrounding areas into the Preserve are likely items for discussion.

Mosquito Abatement District: A no-spray zone encompassing the Preserve boundaries should be established. Use of *Gambusia* is also inappropriate, both because of the seasonal duration of ponding and the likelihood of the fish eating frog egg masses or tadpoles. Alternate means of controlling vectors, if any, without harming frogs or their habitat should be established.

Fort Ord Re-Use Authority (FORA): The sandy soils north and east of the Preserve are within FORA's jurisdiction and the City of Del Rey Oaks' proposed annexation. Additional runoff from new roads, new golf course and impervious commercial surfaces, or other hydrological changes to existing drainage to the east of the Preserve can all lead to increased runoff. Any increases in storm runoff can result in very large increases in sand transport into the Preserve. Measurements in 5 pairs of small watersheds in similar soils surrounding the Pajaro Valley showed that peak flows were normally 10 to 100 times greater in sub-watersheds draining residential areas than the adjacent sub-basins of similar size and properties that were kept in open space (Hecht and Woyshner, 1984). Since sediment transport increases approximately as the square of flow, increases sand delivery to the Preserve of 100 to several thousand times may be expected if drainage from the former Fort Ord lands is not very carefully controlled, perhaps to the extent of reducing the existing inflows to the Preserve.

It is difficult to over-emphasize the importance of preventing sheets of sand from entering the Preserve as a result of land-use or drainage changes during the conversion of Fort Ord. In recent years, accelerated erosion of sandy soils has become a major issue in Monterey and Santa Cruz Counties for which solutions are urgently needed (c.f., Hecht and Woyshner, 1984; USDA Soil Conservation Service, 1984; Hecht and Kittleson, 1998; Swanson Hydrology and Geomorphology, 2001). This may be the largest single challenge facing successful management of the Frog Pond and preservation of a viable drowned-valley wetland. It might also be noted that any increased runoff will represent a decrease in recharge through the dunes surrounding the Preserve, and may constitute the type of major hydrologic change potentially threatening the water supply of the Frog Pond.

4.3 Sedimentation and sequestration

Sedimentation is likely to remain within limits tolerable to the willow woodland and other plant communities at the Frog Pond if sand-size material is kept out of the preserve. Further, constituents entering the Preserve likely to be adsorbed or transformed through contact with fine sediments or organic matter will tend to remain fixed in place or otherwise sequestered from the food chain if the volume of sand and coarser sediment deposited in the Preserve is kept to a bare minimum. Once deposited, areas where silt, clay and organic mucks are deposited should be disturbed as little as possible.

4.4 Alternatives

Three sets of alternative on-site plans can be applied to sedimentation and other water-quality control at this site:

4.1.1 Alternative 1 – Structural control

One approach to preserve the integrity of the pond by maintaining objective-based water quality and minimizing sedimentation is shown in plan view as Figure 4. A schematic cross section is shown in Figure 5. This alternative concentrates water-quality and sedimentation measures in a 'treatment train' confined to the eastern part of the Preserve, as near to the sources and as far from the Frog Pond as feasible. Structural measures include:

- Sedimentation ponds at the locations where the two largest sources of existing and potential pollutants enter the Preserve. These 'forebays', shown as ponds A and B are relatively shallow ponds intended to (a) capture sand and (b) retain spills at accessible sites that can be emptied with a loader when partially full. The ponds are intended to be 2 to 3 and 1 to 2 feet deep, respectively, when emptied, and should not penetrate the summer water table, fully drying in September and October, if not sooner. The two ponds are situated at locations where the number of willows requiring removal is minimized (see figure 2), and where access for equipment from Jim Moore Blvd appears feasible. Both sedimentation forebays are sufficiently large to retain the volume spilled from a tanker truck even when the forebays are half full of sand.

- Water-quality ponds C and D are shallower and larger, and are not intended to be maintained. Their purposes include (a) slowing and settling runoff from minor storms, removing fine sand and most coarse silts from the flows, (b) allowing for nutrient uptake during spring and early summer, and (c) filtering particulates and films through the emergent seasonal vegetation expected to develop around the pond edges. These two ponds will be shaped to a depth slightly above the summer ground-water table, which appears to be about one to three feet below present ground surface, and should desiccate for the season early in summer. The ponds will require the removal of willows and undergrowth over most of their extent. We have tried to position these ponds to minimize the number of trees likely to be lost. It is feasible to retain some of the trees on islands or soil pedestals, as the pond will still perform the three functions outlined above with a reasonable amount of islands or peninsulas, which may also serve as dispersal baffles.

- A diffusion area 400 to 500 feet wide separates Pond D from the main pond. Vegetation in this part of the Preserve exhibits a series of gradients from willows through brush and meadow grasses and into bands of high and low emergent vegetation before reaching the pond. No structural changes are expected in this area. Flow will be directed to the north of the remnant path, into an area where additional removal of sediment, filtration of films and particulates, and supplemental water-quality renovation may take place.

- A set of narrow service roads constructed of packed decomposed granite will impound ponds A, C, and D. With construction and appearance very much like the existing path, the roads will be 10 to 12 feet wide and commonly about two feet above the existing ground surface. The path/road network will also maintain and extend the existing practice of making the Preserve wheelchair accessible.

- The road or levee retaining pond D will extend fully across the Preserve, from the northern slope to the Highway 218 road prism. This feature serves three functions. First, it will retain sediment released from the largest likely episodes, such as might occur if Arroyo Del Rey were to breach the highway and flow into the Preserve. Second, it can serve as a final line of defense in event a large spill enters the

Preserve; it is designed to be easily sealed, such that spills might be kept out of the red-legged frog habitat area in or surrounding the existing Frog Pond. Finally, it can serve as sediment-retention device minimizing delivery of sediment to the Frog Pond itself. The 'Causeway', a feature of similar scale built at Searsville Lake in 1929, served this function for 65 years before eventually being overtopped during the 1998 El Nino (c.f., Balance Hydrologics, 1996).

4.4.2 Alternative 2 – Forebay control only

A second alternative is a reduced sediment-control program incorporating the two forebays. The larger settling basins (ponds C and D) would not be constructed at this time. Alternative 2 is simpler, and will prove most effective if used in combination with erosion control and sediment removal implemented upstream, in both the Arroyo del Rey mainstem and in the northeastern watershed. Initial construction disturbance and capital costs are likely to be substantially less. We anticipate that addition of the larger settling basins will eventually prove necessary to reduce delivery of contaminant-bearing silts and clays to the main pond; however, the two forebays alone offer an opportunity to phase in the sediment-removal program while other elements of Preserve planning are implemented. The two forebays also offer an important level of protection from spills of contaminants at the tanker-truck or semi-trailer size, inhibiting dispersal of contaminants throughout the Preserve.

4.4.3 Alternative 3 – Sediment removal

If on-site structural or source control prove infeasible, a final alternative could be physical removal of sediment accumulating in the Frog Pond. In this alternative, a baseline GIS elevation model map of the Frog Pond would be used to establish a grade and all sediment above the grade and within or immediately adjoing the pond would be mechanically removed. Removal would occur in October or November, when the pond is dry and red-legged frogs of reproductive age have yet to leave their estivation burrows. Rubber-tired equipment would be used to remove the sediment, approximately 500 to 1000 yards per entry, conducted when required – and likely to recur at intervals of perhaps several years. Accumulated sediment would be removed from the site, either as fill or for possible use as inoculum in restored or created wetlands elsewhere within Monterey Peninsula Regional Park District. It is important that the fine-grained material on the bed of the existing wetlands not be unduly disturbed during removal. A biological monitor familiar with this wetland type and the requirements of red-legged frogs would be needed throughout the removal to prevent crushing of frogs or undue disturbance of the bed.

5. SUGGESTED NEXT STEPS

Development of a detailed plan will require additional analysis and planning in the areas of hydrology, geomorphology and water-quality protection; tailoring the physical plan for the specific needs of target species and of a drowned-valley wetland in general, plus refining mitigation (if needed); and developing phasing and implementation plans, including estimates of capital costs and maintenance.

5.1 Geomorphology, hydrology, and water-quality protection

Planning for a sound and sustainable water regime allowing for a typical drowned-valley wetland (including its geomorphic, sedimentologic and water-quality protection elements) will require a number of steps:

- Develop a comprehensive map of such ponds and lakes, perhaps beginning with Roy Gordon's (1974) work, and show key ponds with unique habitat values or issues, such as Valencia Lagoon (excessive and excessively rapid inflow), Ellicott Pond (functioning well), Garin Lake (pesticides and surface-runoff constituents), etc[2].;

- Compute drainage areas for each of the main contributing areas, and assess erosion hazards and sedimentation control options in each;

- Identify likely episodes and responses
  - avulsion of Arroyo del Rey into the Frog Pond
  - incision of one or more of the sandy tributaries
  - logjam formation and potential blowout
  - emergency logging of eucalyptus or other tree species due to freeze, blight, or pathogens

[2] Quite a bit is known about the location, hypsography (variation of depth and area), and water quality of the drowned-valley wetlands under more natural conditions (c.f., summaries in Gordon, 1974; H. Esmaili & Associates, 1978; HEA, 1984); similarly, recent studies of the Watsonville Sloughs, the ponds and vernal pools in Marina, hydrologies of Valencia Lagoon and Ellicott Pond, and water quality in Pinto and College Lakes have helped quantify recent land-use influences.

- chemical spill;

- Quantify the volume of flow retained in the Frog Pond at varying levels, and assess how positive drainage can be routed out of the Preserve without entering the Frog Pond.
  - Survey the existing invertebrates;
  - Design proposed controls and berms
  - Assess the feasibility of directing sediment-laden flows directly out of the Preserve by diversion without passing through the Frog Pond, perhaps with a high-level conveyance from the southwestern corner of the main berm to the outlet south of the existing rock-lined channel and bridge.

Once these steps have been completed, costs for construction and maintenance can be more knowledgeably estimated.

5.2 Biology and wetlands

- Identify criteria for protecting CRLF at this site;
- Develop appropriate mitigation for wetland functions lost during construction or through operation of the forebays and/or placement of the berms;
- Outline a likely monitoring approach and/or program to evaluate general habitat conditions for the frogs

5.3 Planning, Phasing and Permitting

- Identify specific tasks and projects
- Work with FOR A and Caltrans to negotiate operations least likely to affect CRLF and the Preserve.
- Propose phasing
- Develop cost estimates for each phase
- Apply for permits likely to be needed, and CEQA clearance:

- U.S. Fish and Wildlife Service
- California Department of Fish and Game (streambed alteration agreement)
- Army Corps of Engineers
- CEQA document

5.4 Monitoring needs

Immediate data needs for planning the Preserve integrated with adequate water-quality control include:

- **Water-level Data:** Two properly-constructed piezometers should be placed in the eastern half of the Preserve. One piezometer should be constructed at the western edge of the willow woodland east of the Frog Pond to a depth of approximately 8 to 10 feet. Another should be emplaced in the vicinity of pond D. The piezometers can be built using 1-1/2 inch machine-screened PVC, using a 4-inch hand auger, bagged sand, and a small amount of bentonite. Reference points on the casing should be surveyed to a common datum, as well as a staff plate within the Frog Pond itself. Installation should be in late summer or early fall, when the pond is likely to be dry. This will allow the role of perched ground water in sustaining the Frog Pond to be described.

- **Water-quality Data:** The specific conductance, water temperature, and field pH should be measured in both piezometers, the Frog Pond, and any intermittent streams or springs located within the Preserve.

- **Small-channel Inflow Point:** Photographs should be taken once a year at each point where channels enter the Preserve, to assess whether sand delivery is beginning to occur.

6. CONCLUSIONS

1. The Frog Pond is a relatively little-disturbed drowned-valley wetland, a group of wetlands typical of the Monterey Bay region, and home to many of its sensitive species. The drowned-valley wetlands are as much a part of the ecological heritage of the region as vernal pools play in the Central Valley. They form when the mouths of tributaries draining sandy areas – and which have very low natural rates of erosion under virtually all circumstances – are dammed by larger streams receiving much higher sediment rates from more naturally-erodible terrain. The drowned-valley wetland offers an important and functional theme appropriate to the Frog Pond Wetland Preserve.

2. It is feasible to manage the Frog Pond as a remnant drowned-valley wetland. Water-quality and sedimentation are the two primary threats to its ecological viability. The vast preponderance of habitat-impairing sediment originates and is likely to continue to originate from Arroyo del Rey and from the "northeast" tributary entering across Jim Moore Blvd from the southernmost portions of former Fort Ord.

3. Water-quality control is especially important in the Frog Pond and as there is little opportunity for contaminants which enter the wetland to be washed away, as occurs in riverine or slope wetlands.

4. A short series of ponds or wetland flats, each with different functions, can help minimize both sedimentation and delivery of most undesirable constituents to the pond.

5. Design-level work will be needed to develop a complete (a) ecological paradigm, (b) phasing, (c) costs, and (d) permitting for this much-valued natural area.

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