Chapter 3

HABITAT OPTIONS AT THE NORTH WATERFRONT PARK

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Introduction

The North Waterfront Park (NWP) is taking shape at the old Berkeley landfill, 18 years after the park's conception in 1967. Initial design plans were drawn up as the Berkeley dump approached its capacity in the late 1970's. In the major planning phase now underway, park designers need to know more about the biotic potential of the former dump site in order to respond to an increasing public interest in the park design. The purpose of this paper is to inventory the existing terrestrial wildlife and to investigate the viable options for wildlife habitat compatible with local aesthetic interests and intended park use.

Background

The NWP site is located immediately to the north of the Berkeley Marina in west Berkeley, near the privately-owned Santa Fe lands (Figure 1). The 90 acres of landfill has a parallelogram shape, is surrounded on three sides by water, and is bordered by heavy rip-rap. The current undeveloped landscape is mostly barren soil with elevations ranging from 10 to 77 feet above sea level (Hemmann, 1985, personal communication). An access road follows the site perimeter on three sides. The entire landfill structure rises abruptly out of the shallow bay waters in such a way that no mudflats are exposed adjacent to the site at low tide. The landfill was created by the City of Berkeley under a permit from the Army Corps of Engineers for use as a class II sanitary landfill in the 1950's (Spectrum Northwest, 1978). This means that fill material includes household garbage, garden trimmings, soil, and construction materials, but excludes toxic and hazardous

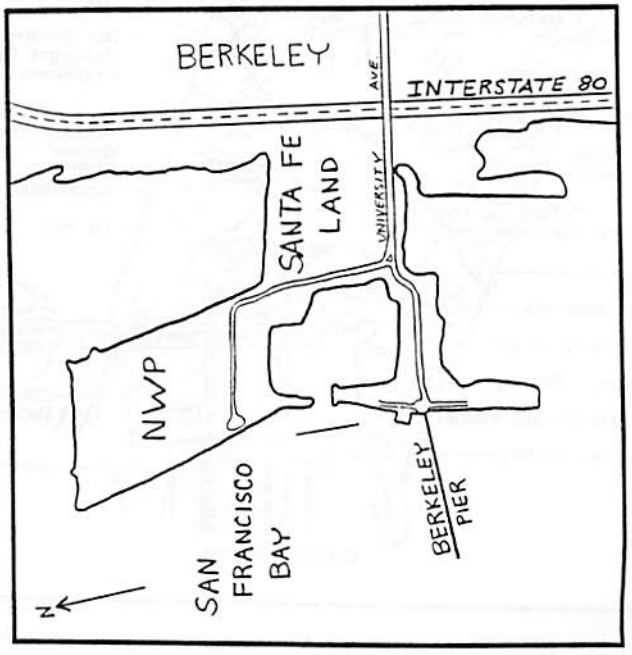

Figure 1. Location of North Waterfront Park (NWP) Site.
Source: After Torrey, 1977.

substances (Montgomery, 1985, personal communication).

The construction method was a cellular one. First, a dike was built around the potential landfill area, leaving a single breach for displaced water to drain from. Individual cells were then diked, their water pumped out, and filled until desired elevations were attained. This cellular construction started at the south end and moved northward as cells were filled (Spectrum Northwest, 1978). At the end of each working day, a 6-inch layer of soil was supposed to be spread over the new refuse to diminish its availability to rats (Hemmann, 1984, personal communication). However, this was not always enforced, and the rat population thrived (Klitz, 1985, personal communication).

Refuse processing for the City was relocated to a transfer station facility in August of 1983. Since that time, the Dump site has been accepting clean fill (asphalt, concrete, and soil) only, to attain final elevations and to meet minimum soil depth requirements of the Regional Water Quality Control Board (Hemmann, 1984, personal communication). For further information on the soil aspects of the NWP, see the paper in this report by Rumall Randhawa.

In 1977, after a period of community input, a NWP Land Use Plan was adopted by the Berkeley City Council (Montgomery, 1985, personal communication). The Plan calls for a park designed for "unstructured recreation", that will be pedestrian- and bicycle-oriented, with a preference for "native California coastal plants and their ecosystems" (Torrey, 1977). The term "unstructured" is specified to mean that no permanent, man-made structures or elements (e.g., bleachers, goalposts) are to be part of park design. Exceptions to this are a park headquarters and public restroom at the extreme south end (Torrey, 1977). Specific recommendations for native plants are specified as one of the needs for future study.

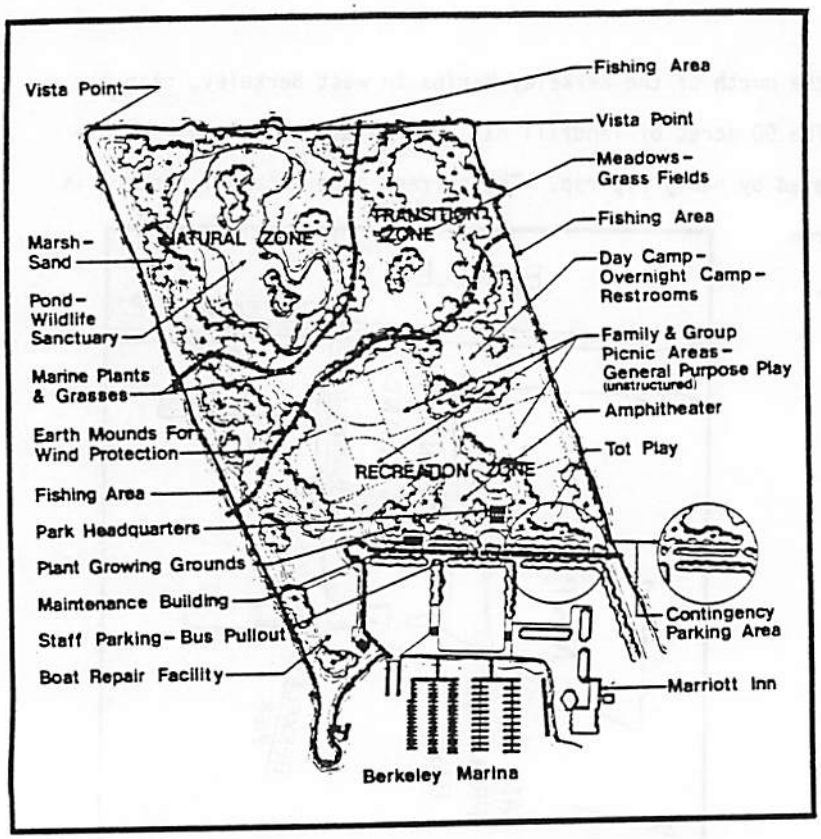

Figure 2. 1977 Conception of the North Waterfront Park.
Source: Torrey, 1977.

The Plan specifies that the park area is to consist of three types of landscape development (Figure 2): (1) a recreation zone, (2) a transition zone, and (3) a natural zone, including a freshwater pond. The recreation zone is described in the Plan as the possible site of large open fields for sports or related use. The natural zone is a site where plant and animal life can exist

and be observed in a natural setting, and the transition zone is to be a buffer between the recreation and natural zones (Torrey, 1977).

The Torrey Plan is considered to be outdated by some planners, because it is not compatible with some of the most recent design concepts (Montgomery, 1985, personal communication). For example, to the dismay of some interest groups, the pond will probably be excluded due to the prohibitive cost of the preventive engineering required to insure against the leaching of undesirable waste products from the landfill (Hemmann, 1984, personal communication). Other new concepts being considered by the City that are not compatible with the 1977 Plan include the accommodation of car parking, shoreline access, and a possible "interpretive center" (Montgomery, 1985, personal communication). A review of the 1977 master plan is expected to begin in 1985.

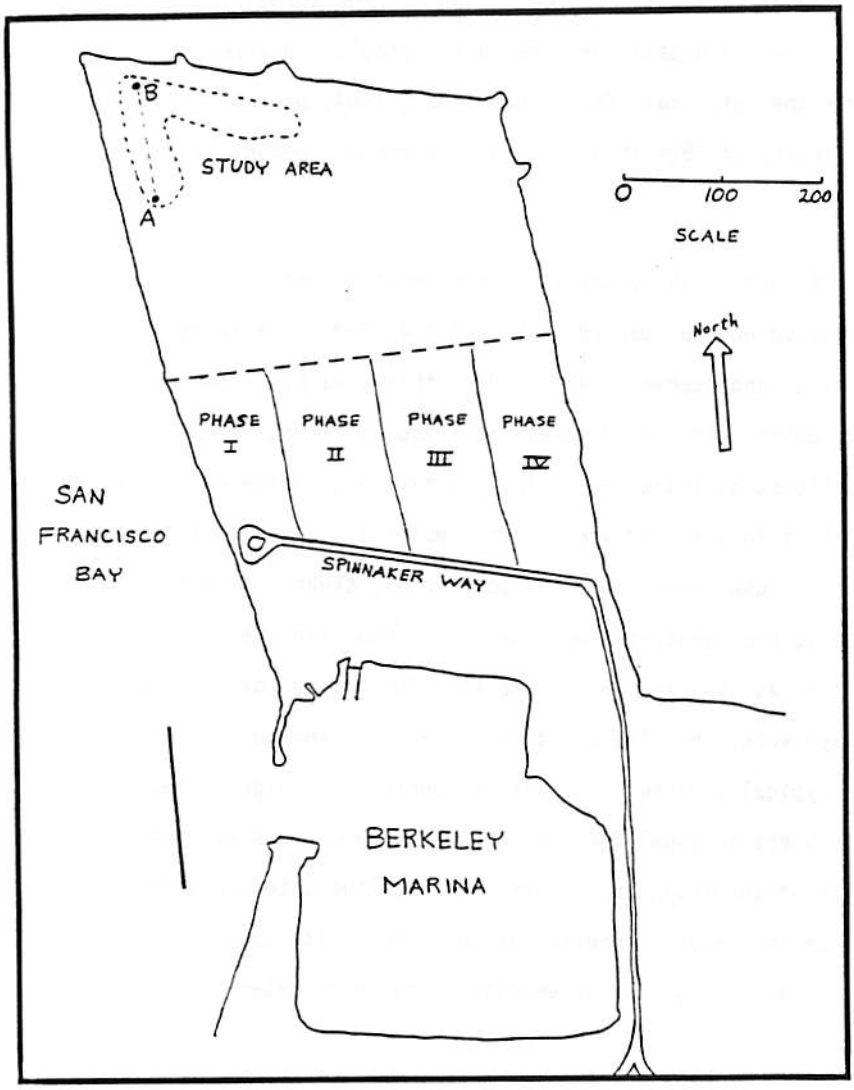

Figure 3. Current North Waterfront Park Development and Study Area.

Source: After Hemmann, 1985.

Construction of the park consists of the sequential installation of four phases (Figure 3) in the southern 40% of the NWP site; the northern 60% will be designed and completed after the fill has been allowed 5-10 years of settling, and as funding becomes available (Hemman, 1984, personal communication). Phase I, initiated in 1980, consists of a parking circle at the end of Spinnaker Way, with a panoramic view of the Bay opposite San Francisco, and nine acres of flat and sloping open space. In 1983, two of the nine acres were planted by DAWN--Design Architects Working with Nature (Kaplow, 1984, personal communication). DAWN, a non-profit organization, is under contract with the City to field-test the performance of various native and non-native plants and make final recommendations for vegetation on Phase I (Danielson, 1985, personal communication). Phase II is at

final grade; pathway construction and planting are scheduled to begin in 1985 (Hemmann, 1985, personal communication). The Phase III and IV sites are currently occupied by Urban Ore (a commercial composting operation), and to the DAWN nursery. Tentative completion dates for Phases III and IV are in 1986 (Hemmann, 1985, personal communication).

Past Studies

Since the NWP is a recently-completed landfill, very little is known about its biotic community. No studies have been made of the current conditions. Mark Blumler and David Amme, employees of DAWN, conducted a survey of the vegetation on the Dump site, noting the abundances of each species (Blumler and Amme, 1980). Since most of what was then vegetated is now covered with fill dirt, the paper by Blumler and Amme is mostly of historical and comparative interest.

While the Dump functioned as a refuse disposal site, its rat population was monitored by the Berkeley Health Department. Their monitoring showed a drastic decline in rat population after the Dump closed, presumably because the refuse was the rats' main food source (Mar, 1984, personal communication). The last monitoring effort was in January of 1984 (Spencer, 1985, personal communication).

Site Description

I inventoried the vegetation on a one-acre band on the undeveloped northwest corner of the site (Figure 3). This was the only undeveloped section not yet capped with soil that had significant vegetation. Presumably, the vegetation has colonized and become established in this area since the dump's closure in 1983. Partially-embedded landfill debris, including shoes, mattresses, tires, and the like, is visible over much of the site. Soil conditions, as indicated by the relative vegetative cover, are highly variable. In some spots, patches ten feet in diameter are almost completely devoid of life. In others, good soil quality is indicated by dense, lush vegetation. In some areas, steam gently but steadily wafts from the ground, presumably due to heat generated by organic decomposition below. In 1979, the northern 60% of the NWP was classified as "barren", with less than 30% ground cover (USFWS, 1979). With the commitment to future landscape work, the site could be upgraded to the more fertile "ruderal" classification. Ruderal areas are typically disturbed sites frequented by a high variety of "weedy" plant species, and are occasionally subject to tidal flooding (USFWS, 1979). This vegetation description roughly coincides with the results of the inventory I performed, but the site elevation and rip-rap protect the NWP from flooding. For this reason, habitat of the future site conditions at final grade may best be characterized by the term "upland", or above mean higher high water level.

Methods

Plant Life

All sampling was carried out in the winter months, from November 1984 to March 1985. For the vegetation inventory I used a quadrat sampling method. A 50 cm by 50 cm square wooden frame (0.25 m^2

inside) was laced with string to determine 25 equal-area quadrats (100 cm^2 each). The quadrat frame was placed on the groundcover every 5 frame lengths, or every 3.25 meters, on alternate sides of a 135 m transect (A-B, Figure 3). At each of 43 locations, 5 quadrats were sampled from the grid according to a list of pre-determined random coordinates which had been established before the inventory. For each of the 5 quadrats inventoried at a given location, I recorded an estimate of the percent ground coverage of each species. Samples were taken of unfamiliar species as they were encountered and later identified with the help of Charli Danielson of DAWN, or with a weed identification book (Robbins, 1941).

After collecting my data, I summed the percent coverages for each species (Table 1). Each species' total was then divided by the total number of quadrats sampled, 215. This gave me the relative percent cover for that species. The formula describing this procedure is:

$$\text{Relative percent cover of species x} = \frac{\text{Sum of (\% ground cover of species x}}{\text{(43 placings x 5 quadrats per placing)}}$$

Species	Sum of percent cover	Relative cover (%)
Burclover	5700	27
Ripgut Brome	5800	27
Mediterranean Thistle	2200	10
Rye Grass	2100	10
Vetch	600	3
Unidentified Fescue	600	3
Geranium Species	300	2
African Daisy	300	2
Common Chickweed	300	2
Unidentified dead grass	200	1
Ox Tounge	< 200	< 1
Common Mustard	< 200	< 1
Sweet Alysum	< 200	< 1
Scarlet Pimpernell	< 200	< 1
Spurge	< 200	< 1
Malva Species	< 200	< 1
Wild Radish	< 200	< 1
Sow Thistle	< 200	< 1
other Mustard	< 200	< 1

Table 1: Vegetation encountered in transect.
Numbers are rounded to the nearest percent.
Bare dirt accounted for 12% of the area sampled.

Animal Life

No quantitative measurements were made of animal life on the site. At first I planned to trap small mammals, but abandoned the idea after learning that the relative abundance of the Norway rat would greatly decrease my chance of catching under-represented species, and that the techniques and equipment were beyond the scope of my study (Klitz, 1984, personal communication). I looked for signs of terrestrial vertebrate life during the course of my vegetation inventory. Accounts of animal life observations

by other individuals were also noted.

Findings

Plant Life

Table 1 lists the plants encountered in my transect. I found that 75% of the area covered by the transect was vegetated by four species, namely Burclover, Ripgut Brome, Mediterranean Thistle, and Rye Grass. Some plant species that were not encountered in the transect but that appeared to be well-established include Coyote Brush, French Broom, Poison Hemlock, Wild Barley (Foxtail), garden-variety Calendula, Dock, Fennel, and Sourgrass.

Animal Life

The dominant animal form that I observed at the NWP was the jackrabbit. I saw between one and three of them on almost every visit to the site. I also observed three different domestic cats on as many separate visits. Rats reportedly still survive limited numbers (Mars, 1984, personal communication), and there were several sightings of a coyote at the NWP (Kaplow, 1984, personal communication). Animal life observation data are presented in Table 2.

Species name	Common Name	Comments, Source (Author unless noted)
Lepus californicus	Jackrabbit	Almost every visit, several sitings.
Felis domesticus	Domestic cat	Three sitings.
Rattus norvegicus	Norway Rat	Occasional. (Eric Mar).
Canis latrans	Coyote	At least two sitings. (David Kaplow).
Microtis californicus	Vole, Field mouse	*Microtis* and *Mus* exist on the adjacent Santa Fe lands (Hall et al, 1983).
Mus musculus	House mouse	

Table 2: Animal life at the NWP

Discussion of Findings

All of the plant species that I encountered in my inventory are mentioned in the 1980 study by Blumler and Amme. In addition, my record of the most common species corresponds roughly to theirs. A major difficulty in identifying certain plant species is that they do not always exhibit distinctive features during the course of my study. The fact that it did not flower, although most of the other plants did, was the chief clue that it was a Rye Grass. A similar problem occurred with Wild Barley (Foxtail). I recorded no occurrences of this species at the time of my survey. At the time of this writing, however, the Foxtail is in full bloom and appears nearly as abundant as Ripgut Brome. This

observation leads me to believe that the Foxtail was there all along, and that some of the coverage recorded as Brome was actually Foxtail which I failed to distinguish.

All four of the dominant species, as well as most of the remaining observed species, are exotic (non-native), annual (as opposed to perennial) species (Blumler and Amme, 1980). Such vegetation looks good in the springtime, but tends to die back and become sparse during the rest of the year. In addition, the large percentage of thistles are not compatible with human recreation. Although these exotic annual plants can generally outcompete native, perennial ones (Stine, 1984, personal communication), and would therefore prove to be a low-maintenance park vegetation, they do not offer as much year-round aesthetic quality as most native plants do. In addition, such vegetation is not consistent with the Master Plan nor with recently expressed public interest.

There appears to be a very limited diversity of animal life at the NWP site, probably due to the small area and barren conditions there. Qualitatively, however, the dietary needs of the animal life I observed can be met by on-site resources. The jackrabbit, vole, rat, and mice all feed on either seeds, bark, or shoots of young plants (Encyclopedia Brittanica, 1971). The annual grasses have a reproductive strategy that involves the production of large numbers of seeds (Stine, 1984, personal communication). The presence of these grasses, in addition to the perennial grasses, herbaceous plants, and shrubs, seems to provide the diet of the smaller, vegetarian mammals. Rats, which inhabit the rip-rap border of the park, will also scavenge the food from litter left behind by careless fishermen (Yescott, 1985, personal communication).

The coyote and the domestic cat are carnivorous predators by nature, and are likely to feed on the rodent and hare (jackrabbit) populations. It is conceivable that the three different cats I observed had temporarily wandered from homes in adjacent developed areas. Two of them, however, did seem more feral in nature. One in particular retreated to what appeared to be an abandoned burrow in an embankment as I approached it, suggesting to me that it may be making itself a home there.

The coyote most likely does not reside at the NWP site. At the time, it may have found refuge in adjacent undeveloped lands that offer more cover, and used the NWP site as a hunting ground. Since no recent sightings have occurred (Kaplow, 1985, personal communication), the coyote may have moved on to another area.

The Potential Habitat

It is worth thinking now about the potential habitat of the future NWP. In nature, ecosystem development takes place by a process called succession (Odum, 1983). In succession, an ecosystem goes through increasingly complex stages of species structure and biological community processes with time. If not interrupted by widespread disaster (natural or otherwise), an ecosystem will reach a "climax community", which is largely determined by the region, soil, and micro-climate. Such natural successional changes take place over a period of years. For example, a climax grassland may take 20 years to establish

equilibrium; an oak woodland may take 100 years (Odum, 1983). Obviously (no matter how slowly the Berkeley city council may move at times), we cannot wait that long for the park ecosystem to establish itself. Furthermore, the constant invasion of exotic plants demands that timely management practices be applied to the ecosystem development process.

A way to develop a native grassland amidst a potential exotic invasion is to use the exotics' opportunistic growth cycle against them. In such a strategy, the first exotic weeds are tilled under when they come up in the fall. Then, subsequent generations are encouraged to grow through the winter and spring (with fertilizer, if necessary). Each time the weeds come up, they are tilled under, depleting the seed stock. Native coastal grasses, such as Stipa pulcra, Melica california, Festuca rubra, and Poa scribilla, can then be planted in the spring and watered with temporary irrigation, with a greater chance of their success. As native seed stocks are limiting, native-compatible exotics such as Scaldis Hard Fescue can be substituted. Such timely planting strategy gives the native grasses a strong foothold against invasion by exotic varieties (Danielsen, 1985).

The stability of an ecosystem increases with increased diversity (Lidiker, 1985, personal communication; Odum, 1983). This assumes, however, that a state of equilibrium has been reached. Merely combining a large variety of organisms in an area does not guarantee that a stable ecosystem will result. For a variety of species to coexist successfully on a given site, such as the NWP, each species must have a sufficiently distinct biological role (Odum, 1983). Individual requirements for territory as well as for the minimum reproduceable population size must be met. In the case of the NWP, an economic factor must also be met, in that seeds for the desired vegetation must be available and used wisely. From a successionary point of view, this means that strategies to establish desirable vegetation should begin as soon as is logistically possible. Animal life cannot be established until a stable, reliable vegetative cover is available. The small mammals listed in Table 3 have sufficiently unique roles that they may coexist--providing that enough of the 90 acres of NWP is available for usable habitat.

A ruderal or an upland habitat poses no particular public health hazards. However, if groves of trees are included in the park design, the habitat is no longer ruderal and may attract squirrels (genus Citellus), as well as raptors (predatory birds). The presence of squirrels in this habitat may pose a potential public health problem. Squirrels have fleas which may carry bubonic plague, and they transfer these fleas to rats (Klitz, 1985, personal communication). Although squirrels do not tend to bite people, rats occasionally do, posing a plague risk to humans. This can be dealt with by further diminishing the Norway rat habitat, such as by filling in the rip-rap with smaller rock, gravel, or concrete. Since some of these proposals have already been made as a means of improving access to the water's edge, this "problem" may be solved before it arises.

In my opinion, the NWP would never support a very diverse animal population. In general, larger animals have a larger minimum space requirement, or home range, than smaller animals (Likider, 1985,

personal communication). The inherently limited space of the NWP, its intended use by humans, and the plans for development of adjacent lands lead me to believe that larger animals such as deer or coyote will never become established there. The largest mammal will probably be a jackrabbit or rodent, and the top predator will probably be a hawk or other raptor.

Conclusion

The current undeveloped NWP conditions are approximately ruderal, dominated by weedy plant species not compatible with existing and foreseeable park design concepts. It is reasonable to expect that these types of plants will invade the currently barren landfill over the next ten years before development, making them difficult to get rid of. Ideally, a management plan to establish native grassland, into which future design concepts could be inserted, should begin immediately. Since final grades and subsequent planting would be contingent on future master plan revision, I recommend that this latter aspect of park design be facilitated as much as possible. Once a native grassland has been established, the park will have realized an advanced stage of native ecosystem succession. Future park development then could incorporate more diverse life forms. With successful succession, regional residents will be able to experience nature as a means of escaping from urban stresses at Berkeley's largest man-made park.

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