LOCH LOMOND VERNAL POOL ECOLOGICAL RESERVE

DRAFT MANAGEMENT PLAN

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The following regional functional supervisors have reviewed and concur with this plan:

Environmental Services	Date	Fisheries Management	Date
Natural Heritage	Date	Wildlife Protection	Date
Wildlife Management	Date		

Approved by:

Regional Manager	Date	Director	Date

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

DRAFT MANAGEMENT PLAN

for

Loch Lomond Vernal Pool Ecological Reserve

September
1994

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I. INTRODUCTION

A. Purpose of Acquisition

1. Protection of habitat for the only known occurrence of Loch Lomond Button Celery (*Eryngium constancei*), a State-candidate Endangered species (at the time of acquisition).
2. Protection of habitat for the best of four occurrences of Many-flowered Navarretia (*Navarretia leucocephala* ssp. *plieantha*), a State-listed Endangered species.
3. Protection of habitat for one of five occurrences of Few-flowered Navarretia (*Navarretia leucocephala* ssp. *pauciflora*).

B. Acquisition History

The vernal pool known as Loch Lomond is the only known location of Loch Lomond Button Celery (*Eryngium constancei*). Threats to the habitat from an illegal attempt to dredge and fill the pool led to the emergency listing of the plant as Federally Endangered in August 1985. Following extensive dialogue and negotiations with the land owner, Loch Lomond was acquired in-fee on March 28, 1988. The 8.22 acre property was purchased at a cost of $46,000.00 with funding provided by the Public Works Board and the Wildlife Conservation Board.

C. Purpose of This Management Plan

The purposes of This Management Plan are as follows:

1) The plan guides management of habitats, species, and programs described herein to achieve the Department's mission to protect and enhance wildlife values.

2) The plan serves as a descriptive inventory of fish, wildlife and native plant habitats which occur on or use this property, and outlines appropriate public uses of these resources.

3) The plan provides an overview of the property's operation and maintenance, and personnel requirements to implement management goals and objectives. It serves as a budget planning aid for annual regional budget preparation.

4) The plan provides a description of potential and actual environmental impacts and subsequent mitigation which may occur during management, and contains environmental documentation to comply with state and federal statutes and regulations.

II. PROPERTY DESCRIPTION

A. Geographical Setting

Loch Lomond Vernal Pool Ecological Reserve (LLVPER) is situated in the northeast portion of a large basin in the Mayacmas Mountains at an elevation of 2800 feet (854 m). Adjacent peaks include Mt. Hannah to the north at 3978 feet (1213 m) and Cobb Mountain to the southwest at 4722 feet (1440 m). The vernal pool site is characterized by a shallow depression in a large flat, while the topography of the surrounding area varies, with slopes from 15 percent to 75 percent.

The property is located in the community of Loch Lomond in southwestern Lake County. It is on the west side of Highway 175 just north of the intersection of Loch Lomond Road. Loch Lomond is somewhat remote, but several routes are possible into the area. A regional map has been provided (Map 1).

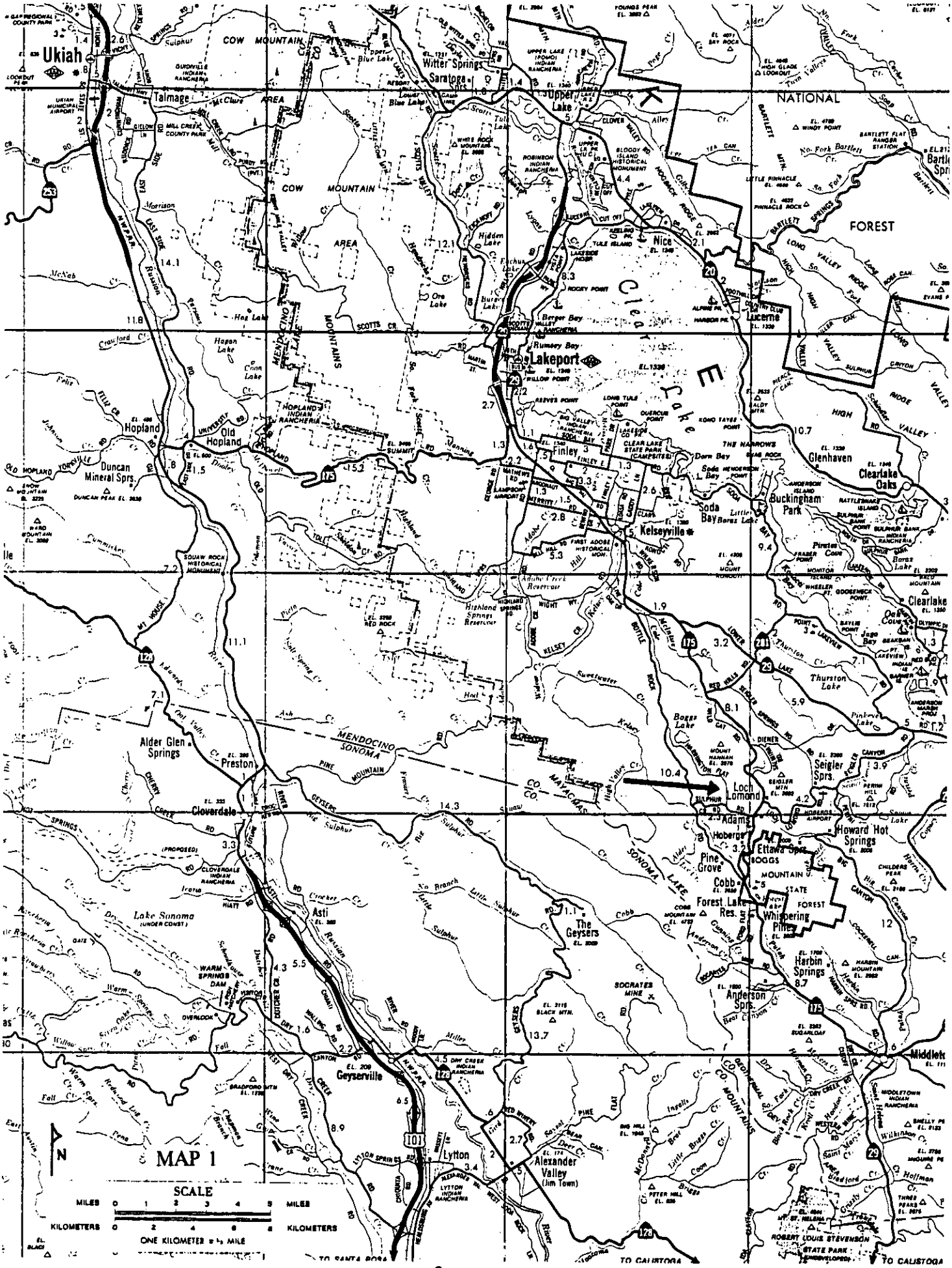
B. Property Boundaries and Adjacent Land Use

The 8.22 acre parcel is situated in the northwest quarter of Section 26, Township 12 North, Range 8 West, in the USGS 7.5 Whispering Pines Quad (Maps 2 and 3). An easement at the northern end of the property is maintained by PG&E for construction, maintenance and operation of electrical and telephone lines and cables. Additionally, a 60-foot, non-exclusive easement and right-of-way have been reserved to Jessie Ruth Moddy et al., and the Grantors William Squire, et al., for road and utility purposes.

Prior to acquisition, this property was part of a mountain resort and was used primarily during the warm season for recreational activities such as softball, cycling and horseback riding. Because it was not protected by a fence it was vulnerable to off-road vehicle intrusion which left scars and ruts on the surface of the vernal pool bed. There is now a post and rail fence around the perimeter of the pool to limit access.

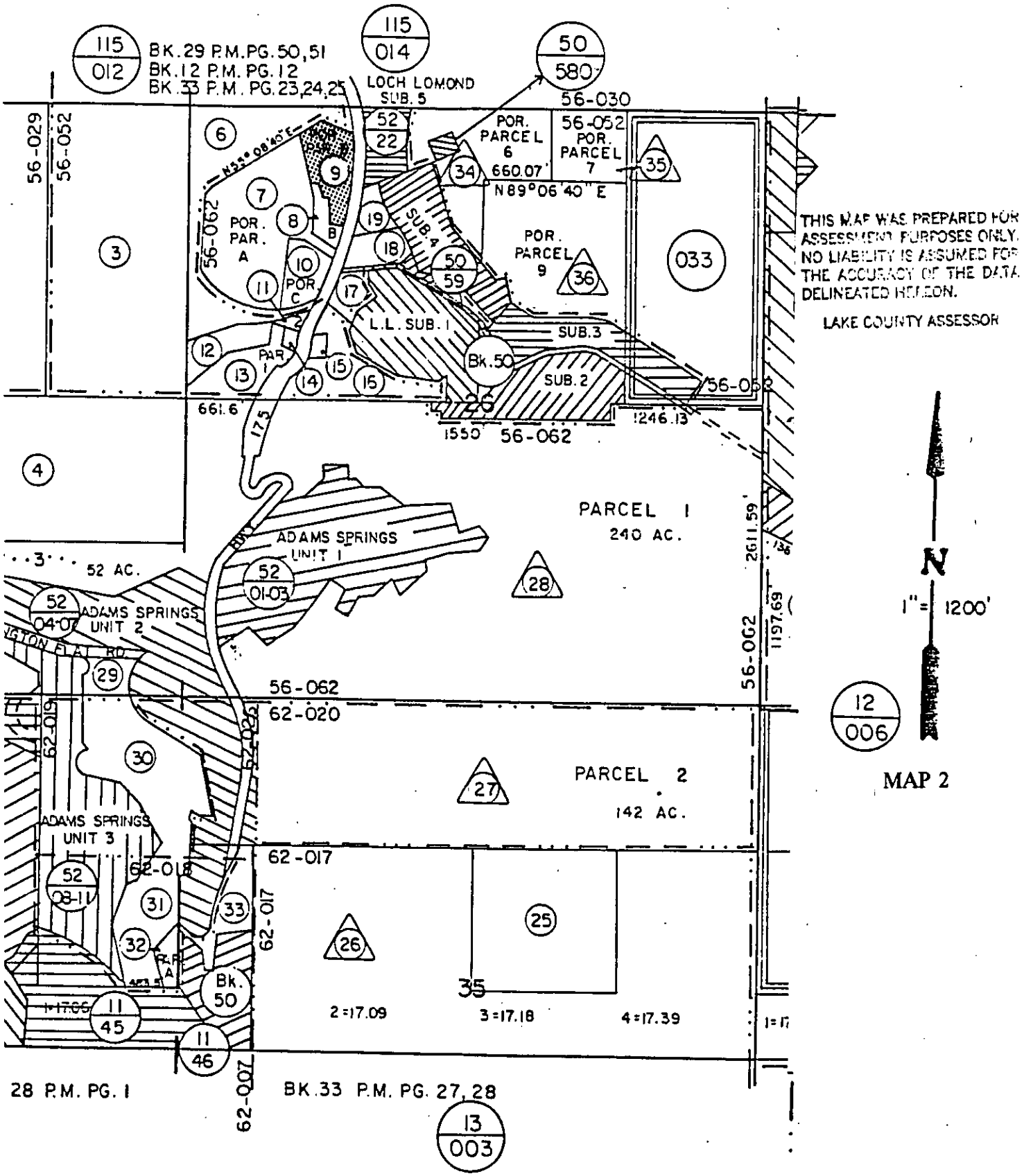
No permanent structures are known to have been built on the bed of the vernal pool, but in 1984 the former landowner excavated a portion of it in an attempt to create a recreation lake. The work was halted before the job was completed because no work permits had been obtained. All the excavated materials were returned to the site.

Currently, there is development planned for a parcel adjacent to the south end of the property. The 3.76 acre parcel has been approved for industrial development although construction has not


Ukiah
Talmage
COW MOUNTAIN
AREA
Witter Springs
Saratoga Springs
Upper Lake
NATIONAL
FOREST
Nice
Lucerne
Clear Lake
Lakeport
Hopland
Old Hopland
Duncan Mineral Sprs.
Finley
Glenhaven
Clearlake Oaks
Buckingham Park
Soda Bay
Kelseyville
Clearlake
Alder Glen Springs
Preston
Cloverdale
MENDOCINO
SONOMA
MAYACMAS
CO.
Loch Lomond
Seigler Sprs.
Howard Hot Springs
Ettawa Spgs.
Boggs Mountain State Forest
Whispering Pines
Harbin Springs
Anderson Spgs.
Middletown
Lake Sonoma
(UNDER CONST.)
Asti
The Geysers
Geyserville
Lytton
Alexander Valley
(Jim Town)
MAP 1
N
SCALE
MILES 0 1 2 3 4 5 MILES
KILOMETERS 0 2 4 6 8 KILOMETERS
ONE KILOMETER = ½ MILE
TO SANTA ROSA
TO CALISTOGA
ROBERT LOUIS STEVENSON STATE PARK

T 12 N R 8 W

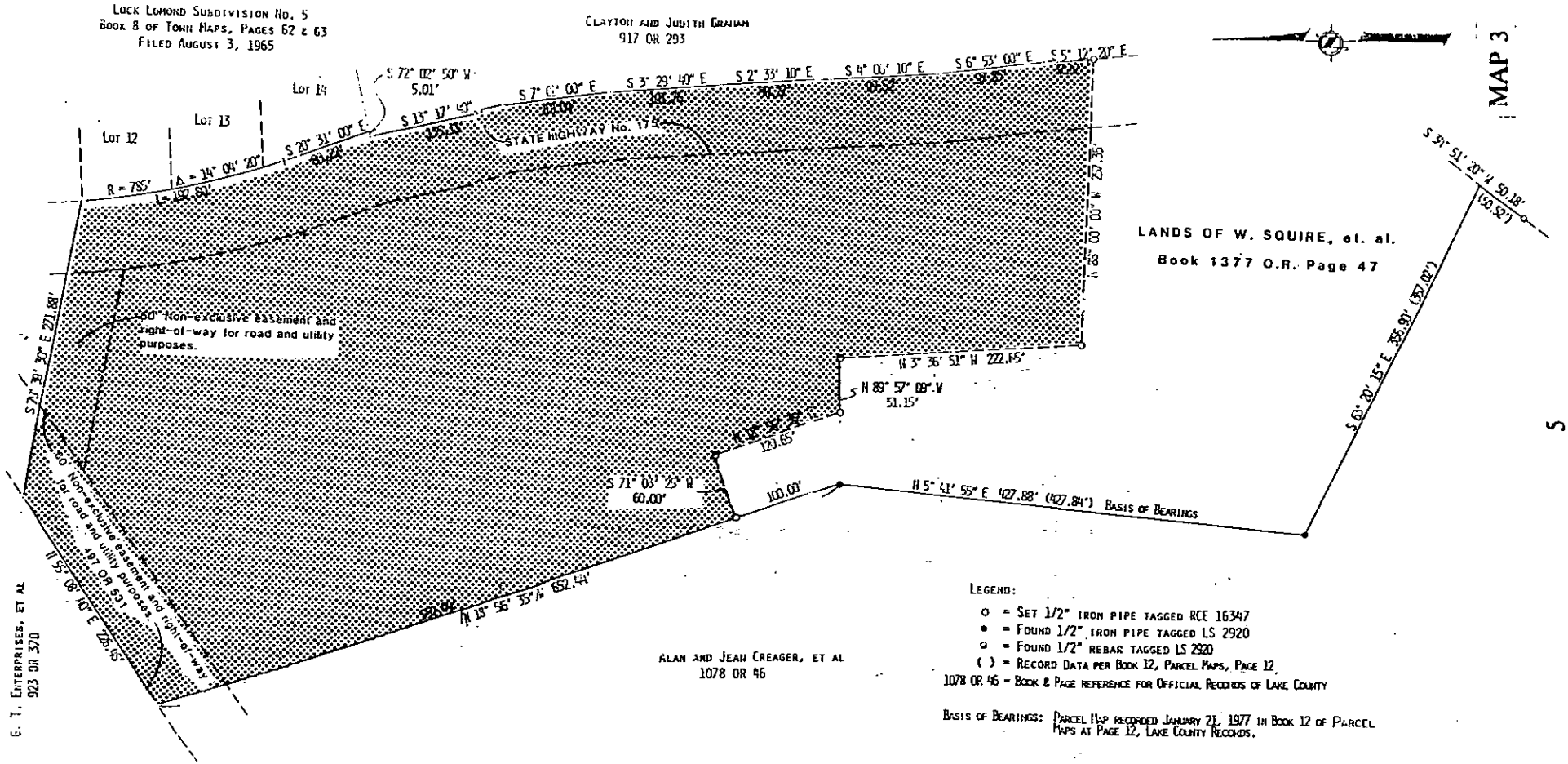
11-067



THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE DATA DELINEATED HEREON.

LAKE COUNTY ASSESSOR

MAP 2


LOCK LOMOND SUBDIVISION NO. 5
BOOK 8 OF TOWN MAPS, PAGES 62 & 63
FILED AUGUST 3, 1965
CLAYTON AND JUDITH GRAHAM
917 OR 293
MAP 3
LOT 12
LOT 13
LOT 14
S 72° 02' 50" W
5.01'
S 7° 01' 03" E
S 3° 29' 49" E
S 2° 33' 10" E
S 4° 05' 10" E
S 6° 53' 00" E
S 5° 12' 20" E
S 13° 17' 43"
S 20° 31' 00" E
STATE HIGHWAY No. 175
R = 785'
Δ = 14° 04' 20"
L = 192.80'
60' Non-exclusive easement and right-of-way for road and utility purposes.
S 21° 30' 30" E 271.88'
60' Non-exclusive easement and right-of-way for road and utility purposes, 497 OR 531
N 55° 08' 40" E 226.45'
N 18° 55' 35" W 652.54'
N 3° 36' 51" W 222.65'
N 89° 57' 09" W
51.15'
120.65'
S 71° 03' 25" W
60.00'
100.00'
N 5° 41' 55" E 427.88' (427.84') BASIS OF BEARINGS
S 03° 20' 15" E 356.99' (357.02')
S 91° 51' 20" W 50.18'
(50.52')
LANDS OF W. SQUIRE, et. al.
Book 1377 O.R. Page 47
G. T. ENTERPRISES, ET AL
923 OR 370
ALAN AND JEAN CREAGER, ET AL
1078 OR 46
LEGEND:
○ = SET 1/2" IRON PIPE TAGGED RCE 16347
● = FOUND 1/2" IRON PIPE TAGGED LS 2920
⊙ = FOUND 1/2" REBAR TAGGED LS 2920
( ) = RECORD DATA PER BOOK 12, PARCEL MAPS, PAGE 12
1078 OR 46 = BOOK & PAGE REFERENCE FOR OFFICIAL RECORDS OF LAKE COUNTY
BASIS OF BEARINGS: PARCEL MAP RECORDED JANUARY 21, 1977 IN BOOK 12 OF PARCEL MAPS AT PAGE 12, LAKE COUNTY RECORDS.

yet started. Some tree clearing, burning and earth moving has begun however, and unless the proper drainage and buffer is provided this activity will impact the vernal pool.

C. Geology, Soils, Climate and Hydrology

The geology of the area consists of volcanic parent material overlaying a Franciscan complex of sandstone, shale, chert, greenstone, and various igneous and metamorphics including serpentinite. The soil of the vernal pool is characterized by a substratum of volcanic ash and rubble over a layer of impervious clay hardpan.

The climate in the Loch Lomond area is characteristically Mediterranean. Annual precipitation varies between 35 and 60 inches, 90 percent of which occurs from November through April. During the winter periods, snow may occasionally blanket the area. The average annual air temperature is 50 to 55 degrees Fahrenheit. Summers are mild and warm, with daytime temperatures typically in the mid 80 to low 90 degree range. Winter temperatures are cool and often below freezing. The average frost-free period is 130 to 180 days.

Direct precipitation is a major source of water for the vernal pool. Watershed runoff from adjacent uplands contributes as well but has been reduced by two manmade features: 1) a dirt road on the north end of the property which directs runoff towards Cole Creek, and 2) a drainage ditch maintained by the California Department of Transportation (CalTrans) which is immediately east of the vernal pool and parallel to Highway 175. The ditch is not connected to the pool and functions primarily for local flood control. It also provides an incidental benefit by preventing road runoff from entering the vernal pool. CalTrans is aware of the significant resource values of the area and uses only mechanical means (no herbicides) for ditch maintenance.

The property just south of the pool also contributes runoff to the pool and this is a subject of concern. The plans for it's development show drainage toward Highway 175, but as of January, 1994, there were no berms or ditches assuring this would happen. As a result, silt, fire residue and unwanted seeds from hay bales that have been brought onto the site are likely to wash into the pool and have a negative impact.

D. Cultural Features

Archaeological evidence indicates that prior to European exploration and settlement, local Native Americans had utilized the uplands of the Cobb Mountain area during warmer seasons. Numerous old hunting camps have been found in the area, including one near Loch Lomond Vernal Pool.

III. HABITAT AND SPECIES DESCRIPTION

A. Vegetation Communities, Habitats and Plant Species

The California Natural Diversity Data Base classifies the Loch Lomond vernal pool as a Northern Volcanic Ash Fall Vernal Pool. Surrounding, and extending to the edge of the pool, is a Coast Range Mixed Coniferous Forest. The forest is dominated by Ponderosa Pine (*Pinus ponderosa*), Douglas Fir (*Pseudotsuga menziesii*), and Black Oak (*Quercus kelloggii*) with a Manzanita (*Arctostaphylos* sp.) and California Lilac (*Ceanothus* sp.) understory. Though both communities share the wet winter/spring and dry summer/fall regime of the Mediterranean climate, the topographic and edaphic characteristics of the vernal pool have resulted in a unique assemblage of plant species.

Vernal pools tend to be small, shallow depressions underlain by an impervious hardpan. They are innundated with standing water during the growing season followed by desiccation during the summer and fall. Vernal pool plants have developed special morphological and physiological characteristics which allow them to succeed in this unusual environment. For example, they exhibit a variety of photosynthetic strategies which enable them to withstand flooded conditions. They are also characteristically annual in habit, surviving the dry season as dormant seed, and the lack of seed dispersal mechanisms ensure that these seeds remain in a suitable habitat. Many species have become so specialized that they are restricted to vernal pools.

Vernal pool endemics at LLVPER which have special status include Loch Lomond Button Celery (*Eryngium constancei*) and an intergrade of Many-flowered Navarretia (*Navarretia leucocephala* ssp. *plieantha*) and Few-flowered Navarretia (*Navarretia leucocephala* ssp. *pauciflora)* (See section III.C.). Other vernal pool endemics found at Loch Lomond include Goldfields (*Lasthenia glaberrima*), Toothed Downingia (*Downingia cuspidata*), Boggs Lake Dodder (*Cuscuta howelliana*), Hernandez Bluecurls (*Trichostemma rubisepalum*) and Monkeyflower (*Mimulus angustatus* and *M. tricolor*). A complete plant inventory is found in Appendix 1.

B. Animal Species

Animal surveys have not been conducted on the site, but the area is known to support a variety of wildlife including deer, raccoons, weasels and fox. Bird species include Great-blue Heron, Mallard, Red-shouldered Hawk, Red-tailed Hawk, Pileated Woodpecker, Steller's Jay, American Robin, Western Bluebird, and Audubon's Warbler. The vernal pool habitat may play an important role in the ecology of the general area since it provides breeding habitat for many insects and frogs which in turn are an important food source for many animals, especially birds and bats. A list of

species associated with vernal pools was generated using the WHR system and is included in Appendix 2.

Management Goals associated with the animal species at LLVPER include revising the WHR listing to more accurately reflect the species make up, conducting animal surveys and developing an inventory of species that use the site.

C. Endangered, Threatened and Rare Species

The following Endangered, Threatened and Rare plant species are known from LLVPER:

Eryngium constancei
Loch Lomond Button Celery

Loch Lomond vernal pool is the only known location in the world of the State and Federally Endangered Loch Lomond Button Celery (*Eryngium constancei*). It is restricted to the vernal pool habitat and is abundant in the deeper parts of the pool.

Navarretia leucocephala ssp. *plieantha*
Many-flowered Navarretia

The Many-flowered Navarretia (*Navarretia leucocephala* ssp. *plieantha*), a State-listed Endangered species, is known only from four other locations in Lake County; 1) Boggs Lake, protected by The Nature Conservancy; 2) Siegler Springs, a small, disturbed population; 3) east of Mt. Hannah Lodge on Hwy 175; 4) and the northern most lake of Steinhart Lakes off of Spruce Grove Road. In Sonoma County it has been found at three sites; 1) two miles south of Windsor, on the south side of Saunders Road; 2) on the Shiloh Ranch development; 3) and Bennett Mountain, where it may no longer exist due to site degradation. It is a vernal pool endemic and is found in abundance throughout the deeper parts of the pool at LLVPER. Alva Day, botanist with the California Academy of Sciences, has concluded that the two subspecies, *Navarretia leucocephala* ssp. *plieantha* and *Navarretia leucocephala* ssp. *pauciflora* are intergrading with one another at LLVPER.

Navarretia leucocephala ssp. *pauciflora*
Few-flowered Navarretia

The Few-flowered Navarretia (*Navarretia leucocephala* ssp. *pauciflora*) is State-listed as Threatened, and is found in only four other locations; 1) Boggs Lake; 2) Manning Flat, a small, threatened population; 3) Hesse Flat; 4) and Ely Flat. It has been seen in two sites in Napa County, both on Atlas Peak Road in Capell Valley; 1) on Mead Ranch; 2) and

about 4.5 miles north of Westgate Drive. This species is also a vernal pool endemic and is found at LLVPER intergrading with the Many-flowered Navarretia.

Perideridia gairdneri ssp. *gairdneri*
Gairdner's Yampah

This species is on the CNPS (California Native Plant Society) 1B list and is considered rare. It occurs in abundance on the western margin of the pool at LLVPER.

IV. MANAGEMENT GOALS AND ENVIRONMENTAL IMPACTS

A. Definitions of Terms Used in This Plan

1. Element: an element refers to any biological, public use, or facility maintenance program as defined below for which goals and objectives have been prepared and presented within this plan.

2. Biological Element: These elements consist of species, habitats, or communities for which specific management goals and objectives have been developed within the plan.

3. Public Use Elements: Public use elements are any recreational scientific, or other uses appropriate to and compatible with the purposes for which this property was acquired.

4. Facility Maintenance Element: This is a general purpose element describing there maintenance and administrative program which must be implemented in order to maintain orderly and beneficial management of the area.

5. Biological Goal: A biological goal is the statement of intended long-range results of management based upon the feasibility of maintaining, enhancing, or restoring species, populations, and/or habitat.

6. Public Use Goal: A public use goal is the statement of the desired type and level of public use compatible with the biological element goals previously specified within the plan.

7. Objective: Objectives are statements of the intended results of management actions which promote the biological, public use, or operations/maintenance goals on the property.

8. Tasks: Tasks are the individual projects or work elements which implement the objective and can be useful as an aid in budget planning for the property.

B. Biological Elements: Goals, Objectives & Environmental Impacts

1) Biological Element: Endangered, Threatened and Rare Plant Species

Goal: Maintain habitat necessary for Loch Lomond Button Celery (*Eryngium constancei*), Many-flowered Navarretia (*Navarretia leucocephala* ssp. *plieantha*), Few-flowered Navarretia (*Navarretia leucocephala* ssp. *pauciflora*) and Gairdner's Yampah (*Perideridia gairdneri* ssp. *gairdneri).*

Objective: Monitor the property for negative impacts and ensure that listed species are maintaining or expanding their distribution within the pool.

a) Task: Develop a schedule for monitoring the property.

b) Task: Conduct informal surveys of the Endangered, Threatened and Rare species on a yearly basis, preferably when each species is in flower.

c) Task: Conduct a grid-based census of Loch Lomond Button Celery in 1994 and repeat frequently enough to determine population trend.

Potential Impacts: None

2) **Biological Element**: Wildlife Populations

Goal: Identification and protection of wildlife species that use LLVPER.

Objective: Develop an inventory of animals that use LLVPER so that Endangered, Threatened and Rare species can be protected.

a) Task: Modify the WHR listing of species using known animal inventories of the area.

b) Task: Conduct animal surveys of the property.

c) Task: Produce an inventory of animals that use LLVPER.

d) Task: Identify species with special status and develop a monitoring program.

Potential Impacts: None

3) **Biological Element**: Vernal Pool Habitat

Goal: To ensure that the vernal pool remains healthy and undisturbed.

Objective: To monitor the pool on a regular basis and remedy any negative impacts.

a) Task: Develop a schedule for monitoring the pool.

b) Task: Follow up on any negative impacts; ensure that the problem is resolved.

c) Task: Contact the land owner of property to the south of the pool and/or the Lake County Planning Department to follow up on negative impacts due to runoff from that property.

Potential Impacts: None

4) **Biological Element**: Forest Habitat

Goal: To ensure that the forest surrounding the vernal pool remains healthy and undisturbed.

Objective: To monitor the forest on a regular basis and remedy any negative impacts.

a) Task: Develop a schedule for monitoring the pool.

b) Task: Follow up on any negative impacts; ensure that the problem is resolved.

Potential Impacts: None

C. Public Use Elements: Goals, Objectives & Environmental Impacts

1) Public Use Element: Interpretive Signs

Goal: To provide information about species and habitats found at LLVPER to the public.

Objective: The installation of permanent, low-maintenance interpretive signs near informal parking areas along Highway 175.

a) Task: Identify location for signs.

b) Task: Determine quantity, size, type, and content of proposed signs.

c) Task: Have signs made and installed.

d) Task: Develop a schedule for monitoring and repair of any damage to signs.

Potential Impacts: Interpretive signs may increase visitation to the site by the public. This could result in trampling of the pool by people anxious to get a closer look at the plants.

Mitigation: Include information on the signs about the sensitive nature of vernal pools, and recommend how they can view the plants without damaging them.

2) Public Use Element: Scientific Research, Surveys or Monitoring by Non-Department Groups or Individuals

Goal: To provide a means by which non-department groups and individuals may conduct scientific research, surveys and monitoring at LLVPER.

Objective: To develop a permitting process for LLVPER

a) Task: Develop a protocol for applicants wishing to conduct studies at LLVPER. This might be distributed to potentially interested organizations and institutions such as CNPS and local Universities.

b) Task: Develop the appropriate application(s) and permits.

c) Task: Assure that anyone proposing to conduct research on Loch Lomond Button Celery first obtain a Memorandum of Understanding through the Natural Heritage Division's Endangered Plant Program.

Potential Impacts: None

D. Facility Maintenance Element: Goals, Objectives & Environmental Impacts

1) Facility Maintenance Element: Rail and Post Fence

Goal: Maintenance of fence surrounding vernal pool

Objective: To limit access to Endangered, Threatened and Rare plant species.

a) Task: Develop a schedule for monitoring the fence.

b) Task: Repair fence as necessary.

Potential Impacts: None

V. OPERATIONS AND MAINTENANCE SUMMARY

A. Operations and Maintenance Tasks to Implement the Plan

See Section IV.

B. Existing Staff and Additional Personnel Needs Summary

1) Existing Personnel

The area manager for LLVPER is the Lake County wildlife unit biologist. The position is presently filled at the Associate Biologist level. Additional personnel include the Assistant Regional Lands Coordinator, presently filled at the Range B, Wildlife Biologist level. The North District Plant Ecologist also contributes to the ongoing administrative and maintenance needs of LLVPER.

2) Additional Personnel Required

One Fish and Wildlife Seasonal Aid (estimated .25 PY) is need to work on fence maintenance and to monitor the property for vandalism and litter.

C. Operations and Maintenance Summary

Goals / Objectives	Priority	Personnel frequency / on-going cost	one-time cost
1. Preserve T&E species / conduct floral survey	1	Plant Ecologist 1 time / yr .04 (PY)	
2. Faunal survey	2	contract	$1200.00
3. Maintain fence	1	Wildlife Biologist temp help as needed	
4. Design entrance sign / install	1	Wildlife Biologist .01 (PY) temp help	$450.00
5. Post property	1	Wildlife Biologist 1 day	
6. Waste / trash removal	1	Wildlife Biologist temp help as needed	

Goals / Objectives	Priority	Personnel frequency / on-going cost	one-time cost
7. Inspection / trespass and patrol	1	Warden Wildlife Biologist on-going	
8. Fabrication / installation of interpretive sign	2	Plant Ecologist / Asso. Wildlife Bio. Wildlife Biologist temp help .06 (PY)	$5000.00

VI. REFERENCES

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APPENDIX I

LIST OF VASCULAR PLANTS

OF

LOCH LOMOND VERNAL POOL ECOLOGICAL RESERVE

1993 - 1994

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INTRODUCTION

Site Description

Loch Lomond Vernal Pool Ecological Reserve (LLVPER) is an 8.22 acre parcel located in a large basin of the Mayacmas Mountains in Lake County, California. The property is located in the community of Loch Lomond; on the west side of Highway 175 just north of the intersection of Loch Lomond Road.

This reserve was established to preserve the only known population of Loch Lomond Button Celery (*Eryngium constancei*). Loch Lomond Button Celery grows in a large vernal pool which occupies most of the reserve. The California Natural Diversity Data Base classifies Loch Lomond vernal pool as a Northern Volcanic Ash Fall Vernal Pool. Surrounding, and extending to the edge of the pool, is a Coast Range Mixed Coniferous Forest. The forest is dominated by Ponderosa Pine (*Pinus ponderosa*), Douglas Fir (*Pseudotsuga menziesii*), and Black Oak (*Quercus kelloggii*) with a Manzanita (*Arctostaphylos* sp.) and California Lilac (*Ceanothus* sp.) understory.

Methods

The property is characterized by relatively even terrain and open vegetation. Therefore, it could be surveyed in a systematic fashion. During the spring and summer of 1993 I walked transects through the forest and vernal pool communities separately, collecting plants and maintaining a field notebook. Areas that appeared significantly diverse were noted and watched more carefully as the season progressed. I also recorded the locations of plants that were not yet in flower to ensure that they would not be missed. I spent a total of eighteen days from March through August surveying and collecting. Follow-up visits in the spring and summer of 1994 resulted in a small number of additions to the collection. Two voucher specimens were collected for all species except common, non-native, annual grasses. The collections have been given to the North Coast Herbarium at Sonoma State University in Rohnert Park, California and the Jepson Herbarium at the University of California at Berkeley.

Plants were identified using The Jepson Manual (Hickman 1993), A California Flora with Supplement (Munz and Keck 1968), Illustrated Flora of the Pacific States (Abrams 1923 - 1960), and A Flora of the Marshes of California (Mason 1969). Specimens from the North Coast Herbarium were used for further verification. Additionally, I consulted with several

people who have special expertise; Alva Day for *Navarretia*, Lincoln Constance for *Eryngium*, Walter Knight for *Arctostaphylos*, Sarah and Paul Baldwin for help with *Grattiola*, and Jake Ruygt who helped by sharing his knowledge of the local flora.

Findings

The final inventory of vascular plants at the LLVPER includes 192 species representing 145 genera and 53 families. The families with the greatest number of species include the Asteraceae with 30, the Poaceae with 21, the Fabaceae with 22, and the Scrophulariaceae with 11. Seventy-four percent of the taxa are natives. Alien (mostly weedy) species comprise the remaining 26 percent, and are primarily located along Highway 175.

FAMILY **Scientific Name (Bold print = Native)** **[Synonym - Munz]** **Common Name**	Habit[1]	Habitat[2]	Abundance[3]	Flowering Time[4]	Special Status[5]
FERNS AND QUILLWORTS					
DENNSTAEDTIACEAE					
Pteridium aquilinum var. ***pubescens*** Bracken Fern	F	MAR	C		
ISOETACEAE					
Isoetes howellii Quillwort		VP	C		
MARSILEACEAE					
Pilularia americana Pillwort		VP	C		
CONIFERS					
CUPRESSACEAE					
Calocedrus decurrens Incense Cedar	T	FOR	O		
PINACEAE					
Pinus ponderosa Ponderosa Pine	T	FOR	C		
Pseudotsuga menziesii var. ***menziesii*** Douglas Fir	T	FOR	C		
FLOWERING PLANTS: DICOTS					
ACERACEAE					
Acer macrophyllum Big-leaf Maple	T	FOR	O		
ANACARDIACEAE					
Toxicodendron diversilobum ***[Rhus diversilobum]*** Poison Oak	S/V	FOR	C	JUNE	

[1] T = Tree, S = Shrub, SB = Subshrub, V = Vine, F = Fern, P = Perennial, B = Biennial, A = Annual

[2] FOR = Forest, RD = Roadside, SVP = South end of vernal pool, VP = vernal pool, MAR = margin of pool

[3] A = Abundant, C = Common, U = Uncommon, O = Occasional

[4] NFL = No flowers observed during study

[5] E = Endangered, T = Threatened, R = Rare, C = California, F = Federal, Cand = candidate for listing, CNPS 1B = CA Native Plant Society recognizes as E, T, or R

	Habit	Habitat	Abundance	Flowering Time	Special Status
APIACEAE					
Eryngium aristulatum var. ***aristulatum*** Coyote Thistle	B/P	VP	O	JULY	
Eryngium constancei Loch Lomond Button Celery	A/P	VP	A	JUNE	FE/CE CNPS 1B
Osmorhiza chilensis	P	FOR	O	MAY	
Perideridia gairdneri ssp. ***gairneri*** Gairdner's Yampah	P	VP/MAR	A	JULY	CNPS 1B
Perideridia kelloggiii Kellogg's Yampah	P	FOR/MAR	C	JULY	
Scandix pectin-veneris Venus' Needle	A	RD	O	MAY	
APOCYNACEAE					
Apocynum cannabinum Indian Hemp	SB	MAR/FOR	C	JUNE	
ASTERACEAE					
Achillea millefolium White Yarrow	P	MAR/FOR	C	JUNE	
Agoseris grandiflora Mountain Dandelion	P	FOR	C	JULY	
Agoseris heterophylla Woodland Agoseris	A	FOR	U	MAY	
Artemisia douglasiana Mugwort	P	RD	C	AUGUST	
Aster chilensis Common California Aster	A	RD	C	AUG	
Baccharis pilularis Coyote Brush	S	FOR	O	AUG	
Carduus pycnocephalus Italian Thistle	B	RD	O	JUNE	
Centaurea solstitialis Yellow Star Thistle	A	RD	U	AUGUST	
Cichorium intybus Chicory	P	SVP	O	JULY	
Cirsium vulgare Bull Thistle	P	RD	U	JULY	
Erigeron inornatus var. ***inornatus*** California Rayless Daisy	P	FOR	C	JULY	

	Habit	Habitat	Abundance	Flowering Time	Special Status
ASTERACEAE					
Eriophyllum lanatum var. ***achillaeoides*** Woolly Sunflower	SB	FOR	C	JUNE	
Filago californica Herba Impia	A	VP	U	JUNE	
Gnaphalium canescens ssp. ***beneolens*** Pearly Everlasting	P	FOR	U	AUGUST	
Hieracium albiflorum Hawkweed	P	FOR	C	JULY	
Hypochaeris glabra Smooth Cat's Ear	A	SVP/MAR	C	MAY	
Hypochaeris radicata Rough Cat's Ears	P	MAR	C	JUNE	
Lactuca saligna	A	RD	C	AUGUST	
Lactuca serriola Prickly Lettuce	A	RD/SVP	C	AUGUST	
Lasthenia glaberrima Goldfields	A	SVP	C	JUNE	
Madia elegans ssp. ***elegans*** Common Madia	A	MAR	C	JULY	
Madia exigua Threadstem Madia	A	MAR	C	MAY	
Madia gracilis Slender Tarweed	A	RD	C	MAY	
Psilocarphus oregonus Woolly Marbles	A	VP	C	MAY	
Senecio vulgaris Common Groundsel	A	RD	C	MAY	
Solidago californica Goldenrod	P	RD	C	AUGUST	
Sonchus asper ssp. *asper* Sow Thistle	A	SVP/RD	C	JULY	
Taraxacum officinale *(T. laevigatum)* Common Dandelion	P	SVP	A	APRIL	
Wyethia angustifolia Mules Ears	P	VP/MAR	C	JUNE	
Wyethia helenoides Mules ears	P	FOR	ONE PLANT	JUNE	

	Habit	Habitat	Abundance	Flowering Time	Special Status
BORAGINACEAE					
Plagiobothrys stipitatus var. ***micranthus*** Popcorn Flower	A	VP	A	MAY	
Plagiobothrys tener Popcorn Flower	A	VP	A	MAY	
BRASSICACEAE					
Brassica nigra Black Mustard	A	RD	U	JUNE	
Cardamine oligosperma Few-seeded Bitter-cress	A	VP	C	APRIL	
Rorippa curvisiliqua Yellow Cress	B	VP	U	MAY	
CALLITRICHACEAE					
Callitriche heterophylla var. ***bolanderi*** Water-Starwort	A	VP	C	APRIL	
CAMPANULACEAE					
Downingia cuspidata Toothed Downingia	A	VP	A	MAY	
Heterocodon rariflorum	A	VP	C	JUNE	
CAPRIFOLIACEAE					
Symphoricarpos albus var. ***laevigatus*** Snowberry	S	FOR	C	JUNE	
CARYOPHYLLACEAE					
Cerastium glomeratum Mouse-ear Chickweed	A	MAR	C	APRIL	
CONVOLVULACEAE					
Calystegia subacaulis ssp. ***subacaulis*** Morning-glory	P	FOR	C	MAY	
CORNACEAE					
Cornus nuttalii Pacific Dogwood	T	FOR	O	APRIL	
CRASSULACEAE					
Crassula aquatica ***[Tillaea aquatica]*** Pigmy-weed	A	VP	U	MAY	

	Habit	Habitat	Abundance	Flowering Time	Special Status
CUSCUTACEAE					
Cuscuta howelliana Boggs Lake Dodder	A	VP	A	JULY	
DIPSACACEAE					
Dipsacus fullonum Wild Teasel	B	RD	U	JULY	
ERICACEAE					
Arbutus menziesii Madrone	T	FOR	O	MARCH	
Arctostaphylos canescens ssp. ***canescens*** Manzanita	S	FOR	C	APRIL	
Arctostaphylos manzanita ssp. ***elegans*** Manzanita	S	FOR	C	APRIL	
EUPHORBIACEAE					
Eremocarpus setigerus Doveweed	A	VP	U	JULY	
FABACEAE					
Cytisus scoparius Scotch Broom	S	RD	C	MAY	
Genista monspessulana *[Cytisus monspessulana]* French Broom	S	RD	C	MAY	
Lathyrus latifolius Perennial Sweet Pea	P	RD	O	JULY	
Lathyrus vestitus Wild Pea	P	FOR	C	JUNE	
Lotus crassifolius var. ***crassifolius***	SB	FOR	U	MAY	
Lotus humistratus	A	FOR	C	MAY	
Lotus purshianus var. ***purshianus***	A	VP	C	JUNE	
Lotus wrangelianus	A	MAR	A	MAY	
Lupinus adsurgens Lupine	P	RD	C	MAY	
Lupinus bicolor Miniature Lupine	A	MAR	U	MAY	
Lupinus latifolius var. ***columbianus*** Lupine	P	FOR	C	JUNE	

	Habit	Habitat	Abundance	Flowering Time	Special Status
FABACEAE					
Melilotus alba White Sweet Clover	A	RD	C	JULY	
Melilotus indica Sour Clover	A	RD	C	MAY	
Rupertia physodes ***[Psoralea physodes]*** Rupert's Scurf-pea	SB	FOR	O	JUNE	
Trifolium campestre Hop Clover	A	FOR	U	MAY	
Trifolium ciliolatum Clover	A	RD	U	MAY	
Trifolium hybridum Alsike Clover	A	RD	U	JUNE	
Trifolium repens White Clover	A	RD	U	JUNE	
Trifolium subterraneum Subterraneum Clover	A	MAR	C	MAY	
Trifolium variegatum phase 5 White-tipped Clover	A	MAR	C	MAY	
Vicia americana var. ***americana*** American Vetch	A	FOR	C	MAY	
Vicia villosa ssp. *varia* Winter Vetch	A	MAR/SVP	C	JUNE	
FAGACEAE					
Quercus kelloggii Black Oak	T	FOR	C	APRIL	
Quercus sp.	T	FOR	U	APRIL	
GENTIANACEAE					
Centaurium davyi Davy's Centaury	A	VP	C	JUNE	
Swertia albicaulis var. ***nitida*** Shining Swertia	P	FOR	O	JULY	
GERANIACEAE					
Erodium cicutarium Filaree	A	RD	C	MAY	
Geranium dissectum Cranesbill	A	RD	U	JUNE	

	Habit	Habitat	Abundance	Flowering Time	Special Status
HYPERICACEAE					
Hypericum concinnum Gold-wire	SB	FOR	C	JUNE	
Hypericum perforatum Klamathweed	SB	RD	U	JULY	
LAMIACEAE					
Mentha pulegium Pennyroyal	P	VP	A	JULY	
Monardella sheltonii ***[Monardella villosa*** ssp. ***sheltonii]*** Coyote Mint	P	FOR	U	JULY	
Pogogyne serpylloides Thyme-like Pogogyne	A	VP	C	MAY	
Stachys ajugoides var. ***ajugoides*** Hedge Nettle	A	FOR	O	JULY	
Trichostemma oblongum Mountain Blue-curls	A	VP	C	JULY	
Trichostemma rubisepalum Hernandez Blue-curls	A	VP	C	JUNE	
LYTHRACEAE					
Lythrum hyssopifolium Hyssop Loosestrife	A	VP	C	JUNE	
ONAGRACEAE					
Clarkia rhomboidea Rhomboid Clarkia	A	MAR	U	JUNE	
Epilobium brachycarpum Willow-herb	A	MAR	U	AUGUST	
Epilobium densiflorum ***[Boisduvalia densiflora]*** Dense-flowered Boisduvalia	A	SVP	C	JULY	
Epilobium pallidum ***[Boisduvalia pallida]*** Pale Boisduvalia	A	VP	C	JULY	
PLANTAGINACEAE					
Plantago lanceolata English Plantain	P	RD/MAR	U	MAY	
POLEMONIACEAE					
Collomia heterophylla Varied-leaved Collomia	A	FOR	C	MAY	

	Habit	Habitat	Abundance	Flowering Time	Special Status
POLEMONIACEAE					
Gilia sinistra ssp. ***pinnatisecta*** ***[Gilia leptalea*** ssp. ***pinnatisecta]*** Bridge's Gilia	A	MAR	U	JULY	
Linanthus bicolor	A	VP	U	MAY	
Navarretia intertexta ssp. ***propinqua***	A	VP	U	JUNE	
Navarretia leucocephala ssp. ***plieantha*** X ssp. ***pauciflora*** Many-Flowered Navarretia Few-Flowered Navarretia	A	VP	A	MAY	CE/CT CNPS 1B
Navarretia squarrosa Skunkweed	A	RD	U	JULY	
POLYGALACEAE					
Polygala californica Milkwort	P	FOR	U	JULY	
POLYGONACEAE					
Polygonum arenastrum Common Knotweed	A	RD	U	JULY	
Polygonum polygaloides ssp. ***confertiflorum*** Knotweed	A	VP	C	MAY	
Rumex acetosella Sheep Sorrel	P	MAR/RD	C	APRIL	
Rumex crispus Curly Dock	P	SVP	C	JUNE	
PORTULACACEAE					
Claytonia exigua	A	FOR	C	APRIL	
Montia linearis Linear-leaved Montia	A	VP	C	APRIL	
PRIMULACEAE					
Dodecatheon hendersonii Shooting Star	P	FOR	C	APRIL	
RANUNCULACEAE					
Ranunculus muricatus Prickly Buttercup	A	VP	O	MAY	
Ranunculus occidentalis Western Buttercup	P	FOR/MAR	COM	APRIL	

	Habit	Habitat	Abundance	Flowering Time	Special Status
RHAMNACEAE					
Ceanothus integerrimus Deer Brush	S	FOR	U	JUNE	
Rhamnus californica ssp. ***californica*** California Coffee Berry	S	FOR	C	JULY	
ROSACEAE					
Amelanchier utahensis Service Berry	S	FOR	O	MAY	
Cercocarpus betuloides var. ***betuloides*** Berch-leaf Mountain Mahogany	S	FOR	O	MAY	
Fragaria vesca Wood Strawberry	P	SVP/MAR	U	JULY	
Heteromeles arbutifolia Toyon	S	FOR	O	JUNE	
Horkelia californica ssp. ***dissita*** California Horkelia	P	MAR/SVP	U	JULY	
Potentilla glandulosa ssp. ***glandulosa*** Cinquefoil	P	FOR	U	MAY	
Prunus sp.	S	FOR	O	NFL	
Rosa spithamea Ground Rose	SB	FOR	U	JULY	
Rubus ursinus California Blackberry	SB	FOR	U	MAY	
RUBIACEAE					
Galium aparine Goose Grass	A	FOR	U	MAY	
Galium bolanderi Bolander's Bedstraw	P	FOR	U	MAY	
Galium californicum ssp. ***californicum*** California Bedstraw	P	FOR	U	MAY	
Galium parisiense Wall Bedstraw	A	RD	U	MAY	
SCROPHULARIACEAE					
Castilleja applegatei ssp. ***martinii*** Paintbrush	P	FOR	O	JUNE	

	Habit	Habitat	Abundance	Flowering Time	Special Status
SCROPHULARIACEAE					
Collinsia sparsiflora var. ***sparsiflora*** Few-flowered Blue-eyed Mary	A	MAR	C	MAY	
Cordylanthus tenuis ssp. ***tenuis*** ***[C. pilosis*** ssp. ***bolanderi]*** Bird's Beak	A	FOR	O	AUGUST	
Gratiola ebracteata Hedge-hyssop	A	VP	C	MAY	
Mimulus angustatus Monkeyflower	A	VP	C	APRIL	
Mimulus tricolor Monkeyflower	A	VP	C	JUNE	
Pedicularis densiflora Indian Warrior	P	FOR	U	APRIL	
Penstemon heterophyllus var. ***heterophyllus*** Beardtongue	P	FOR	U	AUGUST	
Verbascum blattaria Moth Mullein	B	RD	O	JULY	
Verbascum thapsus Turkey Mullein	B	RD	U	JULY	
Veronica peregrina ssp. ***xalapensis*** Speedwell	A	VP	U	MAY	
VALERIANACEAE					
Plectritis brachystemon	A	VP	COM	MAY	
VERBENACEAE					
Verbena lasiostachys var. ***scabrida*** ***[V. robusta]*** Robust Vervain	P	FOR	O	JUNE	
VIOLACEAE					
Viola lobata Pine Violet	P	FOR	U	APRIL	
Viola pedunculata Johny-jump-up	P	FOR	U	APRIL	
VISCACEAE					
Phoradendron villosum Oak Mistletoe	S	FOR	U	NFL	

FLOWERING PLANTS: MONOCOTS

	Habit	Habitat	Abundance	Flowering Time	Special Status
CYPERACEAE					
Carex dudleyi Dudley's Sedge	P	SVP	O	JULY	
Carex gracilior Slender Sedge	P	MAR	C	APRIL	
Cyperus esculentus Nut Sedge	P	RD	U	JULY	
Eleocharis macrostachya Pale Spike-rush	P	VP	C	JUNE	
IRIDACEAE					
Iris macrosiphon Slender-tubed Iris	P	FOR	C	JUNE	
JUNCACEAE					
Juncus dubius Mariposa Rush	P	VP	C	JUNE	
Juncus hemiendytus var. ***hemiendytus***	P	VP	O	MAY	
Juncus bufonius var. ***bufonius*** Toad Rush	P	VP	C	JUNE	
Luzula comosa Common Wood-rush	P	MAR	U	APRIL	
JUNCAGINACEAE					
Lilaea scilloides Flowering Quillwort	A	VP	O	MAY	
LILIACEAE					
Brodiaea elegans Harvest Brodiaea	P	MAR	C	JUNE	
Calochortus tolmiei Pussy Ears	P	FOR/MAR	C	MAY	
Chlorogalum pomeridianum var. ***pomeridianum*** Soaproot	P	FOR	U	JULY	
Dichelostemma capitatum ssp. ***capitatum*** Blue Dicks	P	FOR	U	MAY	
Triteleia hyacinthina White Brodiaea	P	VP	U	JUNE	
Zygadenus micranthus var. ***micranthus*** Death Camas	P	MAR	U	MAY	

	Habit	Habitat	Abundance	Flowering Time	Special Status
ORCHIDACEAE					
Piperia transversa	P	FOR	O	JULY	
Spiranthes porrifolia Ladies Tresses	P	SVP	O	JULY	
POACEAE					
Agrostis exarata Bent Grass	A	MAR	C	JUNE	
Aira caryophyllea Silver European Hairgrass	A	FOR/MAR	C	MAY	
Alopecurus saccatus Foxtail	A	VP	C	JUNE	
Anthoxanthum odoratum Sweet Vernal Grass	A	VP	C	MAY	
Avena barbata Slender Wild Oat	A	RD	U	JUNE	
Avena fatua Wild Oat	A	RD	C	JUNE	
Briza minor Quaking Grass	A	RD	U	JUNE	
Bromus carinatus var. carinatus California Brome	P	FOR	C	JUNE	
Bromus diandrus *[B. rigidus* var. *gussonei]* Ripgut Grass	A	RD	C	JUNE	
Bromus hordeaceus *[B. mollis; B. racemosus; B. scoparius]* Soft Chess	A	RD	C	JUNE	
Bromus catharticus Rescue Grass	P	RD	U	JULY	
Danthonia californica var. californica California Oatgrass	P	VP	C	JUNE	
Deschampsia danthoniodes Annual Hairgrass	A	VP	C	JUNE	
Elymus glaucus ssp. ***jepsonii*** Blue Wildrye	P	FOR	C	JUNE	
Festuca californica California Fescue	P	FOR	O	JUNE	
Glyceria sp. Mannagrass	P	MAR	C	JUNE	

	Habit	Habitat	Abundance	Flowering Time	Special Status
POACEAE					
Holcus lanatus Common Velvet Grass	P	SVP	A	JUNE	
Hordeum brachyantherum ssp. ***californicum*** ***[H. californicum]*** Meadow Barley	P	VP/MAR	U	JUNE	
Hordeum marinum ssp. *gussoneanum* *[H. hystrix; A. geniculatum]* Mediterranean Barley	A	VP/MAR	C	JUNE	
Phleum pratense Cultivated Timothy Grass	P	RD/VP	U	JUNE	
Vulpia bromoides *[Festuca bromoides; F. dertonensis]*	A	RD	C	JUNE	

APPENDIX II

A POPULATION CENSUS OF LOCH LOMOND BUTTON CELERY (*ERYNGIUM CONSTANCEI*) AT LOCH LOMOND VERNAL POOL ECOLOGICAL RESERVE

INTRODUCTION

Loch Lomond Button Celery (*Eryngium constancei*) was first described by Sheikh in 1983. The only known population of the plant occurs in Loch Lomond vernal pool in the Mayacmas Mountains of Lake County, California. Loch Lomond Button Celery was emergency listed as Federally Endangered in August 1985 in response to an attempt by the landowner to create a lake in the bed of the vernal pool. In March of 1988 the property was bought by the State of California and established as Loch Lomond Vernal Pool Ecological Reserve (LLVPER).

Although Loch Lomond Button Celery is abundant in Loch Lomond vernal pool, baseline data is necessary to accurately assess population fluctuations that might occur in response to environmental stresses. In May and June of 1994 a grid-based census of Loch Lomond Button Celery was carried out to estimate the population and establish the distribution of the species within the pool.

METHODOLOGY

A grid of four by four meter plots (16 m^2) was set up within the vernal pool using stake flags as plot corner markers. The margins of the grid were determined by the discontinued occurrence of Loch Lomond Button Celery. Permanent grid markers were installed at five points on the grid so that future censuses could be conducted using the same methodology.

Each plot was sampled by counting every plant in a one by one meter area. The sample was taken from an area judged to be representative of the plot.

FINDINGS

Loch Lomond Button Celery was found to be distributed throughout the pool; no plot within the grid was without some plants. Some areas of the pool had densities as high as 3000 plants per square meter while other plots, especially along the margins, had very low counts. The overall population is estimated to be 1,935,216 based on a sampling of 1043 plots.

This census shows that, currently, Loch Lomond Button Celery has a healthy population. However, LLVPER is only 8.22 acres; only slightly larger than the vernal pool itself. Any disturbances in the surrounding watershed could greatly impact the population of Loch Lomond Button Celery. Future management plans should include scheduled censuses and the enlargement of LLVPER by the acquisition of adjacent properties.

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APPENDIX III

Ecology and Habitat of *Eryngium* species

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APPENDIX IV

WHR Species List

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CALIFORNIA DEPARMENT OF FISH AND GAME
Database Version: 5.0

SPECIES SUMMARY LIST

NOTICE

The lists of animals generated by the California Wildlife Habitat Relationships (WHR) Database provide predictions for all of the regularly occurring species of terrestrial vertebrates potentially found in the habitat(s), geographic location(s) and season(s) specified. In most cases, the number of species predicted by the database exceeds the number detected in field studies. However, the probability of detecting all predicted species increases when larger land areas and longer time periods are considered. Differences between predicted and observed lists is due, in part, to the underlying assumptions of the WHR system (see Airola 1988). The assumptions most influencing the species list are: (1) habitats are available in the proper mix for species requiring a juxtaposition of two or more habitats; (2) all special habitat elements are present in adequate amounts for species requiring the elements; and (3) adequate amounts of habitat are available.

Therefore, the user should compare the species lists produced by the compter database with the species accounts in the appropriate volume of California's Wildlife (Zeiner et al. 1988, Zeiner et al. 1990). The accounts allow WHR users to refine the predicted species list by eliminating species unlikely to occur in the study area because, for example, a special habitat element is absent, or the area is outside the species' known geographic range.

Finally, it must be acknowledged that wildlife populations are inherently dynamic in space and time, and competition, barriers, and historic overharvesting also influence wildlife populations. Therefore, differences between predicted and observed species lists will occur. The predicted species lists are intended to be used by qualified Wildlife Biologists in conjunction with the supporting WHR publications (Airola 1988, Mayer and Laudenslayer 1988, Zeiner et al. 1988, Zeiner et al. 1990). At a minimum, field observations of the study area are needed to identify WHR habitat types and stages and special habitat elements.

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SPECIES SUMMARY LIST

SELECTION CRITERIA:

Locations:
LAKE COUNTY

Season(s) in Location:
Yearlong

Habitats:

1	PONDEROSA PINE	SMALL TREE	MODRTE	40-59%	(4M)
2	PONDEROSA PINE	MED/LARGE TREE	SPARSE	10-24%	(5S)
3	MONTANE HARDWOOD-CONIFER	SAPLING TREE	OPEN	25-39%	(2P)
4	MONTANE HARDWOOD-CONIFER	SMALL TREE	SPARSE	10-24%	(4S)
5	MONTANE HARDWOOD-CONIFER	MED/LARGE TREE	OPEN	25-39%	(5P)
6	MIXED CONIFER	MED/LARGE TREE	OPEN	25-39%	(5P)
7	DOUGLAS-FIR	SMALL TREE	SPARSE	10-24%	(4S)
8	MONTANE RIPARIAN	SAPLING TREE	SPARSE	10-24%	(2S)
9	ANNUAL GRASS	SHORT HERB	SPARSE	2-09%	(1S)
10	PERENNIAL GRASS	SHORT HERB	SPARSE	2-09%	(1S)
11	WET MEADOW	SHORT HERB	MODRTE	40-59%	(1M)
12	FRESH EMERGENT WETLAND	SHORT HERB	MODRTE	40-59%	(1M)

Season(s) in Habitat:
Yearlong

Habitat reproduction level required: H
Habitat feeding level required: H
Habitat cover level required: H

Elements Included:
ACORNS
ALGAE
AMPHIBIANS
AQUATICS, EMERGENT
AQUATICS, SUBMERGED
BERRIES
BIRDS, LARGE
BIRDS, MEDIUM
BIRDS, SMALL
BRUSH PILE
CARRION
CONES
DUFF

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SPECIES SUMMARY LIST

EGGS	
FENCES	
FERN	
FLOWERS	
FORBS	
FRUITS	
FUNGI	
GRAIN	
GRAMINOIDS	
GRASS/WATER	
INSECTS, FLYING	
INSECTS, TERRESTRIAL	
INVERTEBRATES	
INVERTEBRATES, AQUATIC	
LAYER, HERBACEOUS	
LAYER, SHRUB	
LAYER, TREE	
LICHENS	
LOG, MEDIUM	Rotten
MAMMALS, LARGE	
MAMMALS, MEDIUM	
MAMMALS, SMALL	
MOSS	
NECTAR	
NUTS	
PONDS	
REPTILES	
ROOTS	
SAP	
SEEDS	
SHRUBS	
SNAG, LARGE	Rotten
SNAG, LARGE	Sound
SNAG, MEDIUM	Rotten
SNAG, MEDIUM	Sound
SOIL, ORGANIC	
STREAMS, INTERMITTENT	
STUMP	Rotten
STUMP	Sound
TREE LEAVES	
TREE, BROKEN TOP LIVE	

SPECIES SUMMARY LIST

TREE, WITH CAVITIES
TREE, WITH LOOSE BARK
TREE/SHRUB
TREE/WATER
TREES, FIR
TREES, HARDWOOD
TREES, PINE
VERNAL POOLS
WATER

Element reproduction level required: E
Element feeding level required: E
Element cover level required: E

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY	STATUS 123456789 FFCCCCFBH ETETPSSS	C P S
A007	CALIFORNIA NEWT	Taricha torosa	SALAMANDRIDAE		
A008	RED-BELLIED NEWT	Taricha rivularis	SALAMANDRIDAE		
A039	PACIFIC TREEFROG	Hlya regilla	HYLIDAE		
A046	BULLFROG	Rana catesbeiana	RANIDAE	9	
B049	AMERICAN BITTERN	Botaurus lentiginosus	ARDEIDAE		
B052	GREAT EGRET	Casmerodius albus	ARDEIDAE		
B076	WOOD DUCK	Aix sponsa	ANATIDAE	9	
B105	COMMON MERGANSER	Mergus merganser	ANATIDAE	9	
B108	TURKEY VULTURE	Cathartes aura	CATHARTIDAE		
B111	BLACK-SHOULDERED KITE	Elanus caeruleus	ACCIPITRIDAE	5	
B113	BALD EAGLE	Haliaeetus leucocephalus	ACCIPITRIDAE	1 3 5	
B114	NORTHERN HARRIER	Circus cyaneus	ACCIPITRIDAE	6	
B116	COOPER'S HAWK	Accipiter cooperii	ACCIPITRIDAE	6	
B119	RED-SHOULDERED HAWK	Buteo lineatus	ACCIPITRIDAE		
B127	AMERICAN KESTREL	Falco sparverius	FALCONIDAE		
B133	RING-NECKED PHEASANT	Phasianus colchicus	PHASIANIDAE	9	
B134	BLUE GROUSE	Dendragapus obscurus	PHASIANIDAE	7 9	
B138	TURKEY	Meleagris gallopavo	PHASIANIDAE	9	
B140	CALIFORNIA QUAIL	Callipepla californica	PHASIANIDAE	9	
B141	MOUNTAIN QUAIL	Oreortyx pictus	PHASIANIDAE	9	
B145	VIRGINIA RAIL	Rallus limicola	RALLIDAE		
B148	COMMON MOORHEN	Gallinula chloropus	RALLIDAE	9	
B149	AMERICAN COOT	Fulica americana	RALLIDAE	9	
B158	KILLDEER	Charadrius vociferus	CHARADRIIDAE		
B250	ROCK DOVE	Columba livia	COLUMBIDAE	9	
B251	BAND-TAILED PIGEON	Columba fasciata	COLUMBIDAE	9	

SPECIES SUMMARY LIST

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY	STATUS 123456789 FFCCCCFBH ETETPSSS	C P S
B255	MOURNING DOVE	Zenaida macroura	COLUMBIDAE		9
B274	NORTHERN SAW-WHET OWL	Aegolius acadicus	STRIGIDAE		
B294	LEWIS' WOODPECKER	Melanerpes lewis	PICIDAE		
B296	ACORN WOODPECKER	Melanerpes formicivorus	PICIDAE		
B299	RED-BREASTED SAPSUCKER	Sphyrapicus ruber	PICIDAE		
B302	NUTTALL'S WOODPECKER	Picoides nuttallii	PICIDAE		
B304	HAIRY WOODPECKER	Picoides villosus	PICIDAE		
B305	WHITE-HEADED WOODPECKER	Picoides albolarvatus	PICIDAE		
B307	NORTHERN FLICKER	Colaptes auratus	PICIDAE		
B321	BLACK PHOEBE	Sayornis nigricans	TYRANNIDAE		
B337	HORNED LARK	Eremophila alpestris	ALAUDIDAE		
B339	TREE SWALLOW	Tachycineta bicolor	HIRUNDINIDAE		
B345	GRAY JAY	Perisoreus canadensis	CORVIDAE		
B353	AMERICAN CROW	Corvus brachyrhynchos	CORVIDAE		9
B356	MOUNTAIN CHICKADEE	Parus gambeli	PARIDAE		
B357	CHESTNUT-BACKED CHICKADEE	Parus rufescens	PARIDAE		
B358	PLAIN TITMOUSE	Parus inornatus	PARIDAE		
B361	RED-BREASTED NUTHATCH	Sitta canadensis	SITTIDAE		
B362	WHITE-BREASTED NUTHATCH	Sitta carolinensis	SITTIDAE		
B363	PYGMY NUTHATCH	Sitta pygmaea	SITTIDAE		
B364	BROWN CREEPER	Certhia americana	CERTHIIDAE		
B366	ROCK WREN	Salpinctes obsoletus	TROGLODYTIDAE		
B367	CANYON WREN	Catherpes mexicanus	TROGLODYTIDAE		
B372	MARSH WREN	Cistothorus palustris	TROGLODYTIDAE		
B373	AMERICAN DIPPER	Cinclus mexicanus	CINCLIDAE		
B375	GOLDEN-CROWNED KINGLET	Regulus satrapa	MUSCICAPIDAE		
B380	WESTERN BLUEBIRD	Sialia mexicana	MUSCICAPIDAE		
B381	MOUNTAIN BLUEBIRD	Sialia currucoides	MUSCICAPIDAE		
B382	TOWNSEND'S SOLITAIRE	Myadestes townsendi	MUSCICAPIDAE		
B386	HERMIT THRUSH	Catharus guttatus	MUSCICAPIDAE		
B389	AMERICAN ROBIN	Turdus migratorius	MUSCICAPIDAE		
B411	EUROPEAN STARLING	Sturnus vulgaris	STURNIDAE		
B417	HUTTON'S VIREO	Vireo huttoni	VIREONIDAE		
B435	YELLOW-RUMPED WARBLER	Dendroica coronata	EMBERIZIDAE		
B487	RUFOUS-CROWNED SPARROW	Aimophila ruficeps	EMBERIZIDAE		
B505	SONG SPARROW	Melospiza melodia	EMBERIZIDAE		6
B512	DARK-EYED JUNCO	Junco hyemalis	EMBERIZIDAE		
B519	RED-WINGED BLACKBIRD	Agelaius phoeniceus	EMBERIZIDAE		
B520	TRICOLORED BLACKBIRD	Agelaius tricolor	EMBERIZIDAE		6
B521	WESTERN MEADOWLARK	Sturnella neglecta	EMBERIZIDAE		
B524	BREWER'S BLACKBIRD	Euphagus cyanocephalus	EMBERIZIDAE		
B528	BROWN-HEADED COWBIRD	Molothrus ater	EMBERIZIDAE		

SPECIES SUMMARY LIST

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY	STATUS 123456789 FFCCCCFBH ETETPSSS	C P S
B536	PURPLE FINCH	Carpodacus purpureus	FRINGILLIDAE		
B539	RED CROSSBILL	Loxia curvirostra	FRINGILLIDAE		
B542	PINE SISKIN	Carduelis pinus	FRINGILLIDAE		
B546	EVENING GROSBEAK	Coccothraustes vespertinus	FRINGILLIDAE		
M001	VIRGINIA OPOSSUM	Didelphis virginiana	DIDELPHIDAE		
M006	ORNATE SHREW	Sorex ornatus	SORICIDAE	6	
M012	TROWBRIDGE'S SHREW	Sorex trowbridgii	SORICIDAE		
M018	BROAD-FOOTED MOLE	Scapanus latimanus	TALPIDAE		
M025	LONG-EARED MYOTIS	Myotis evotis	VESPERTILIONIDAE		
M027	LONG-LEGGED MYOTIS	Myotis volans	VESPERTILIONIDAE		
M030	SILVER-HAIRED BAT	Lasionycteris noctivagans	VESPERTILIONIDAE		
M032	BIG BROWN BAT	Eptesicus fuscus	VESPERTILIONIDAE		
M034	HOARY BAT	Lasiurus cinereus	VESPERTILIONIDAE		
M038	PALLID BAT	Antrozous pallidus	VESPERTILIONIDAE	6	
M045	BRUSH RABBIT	Sylvilagus bachmani	LEPORIDAE	6	9
M051	BLACK-TAILED HARE	Lepus californicus	LEPORIDAE		9
M072	CALIFORNIA GROUND SQUIRREL	Spermophilus beecheyi	SCIURIDAE		
M077	WESTERN GRAY SQUIRREL	Sciurus griseus	SCIURIDAE		9
M081	BOTTA'S POCKET GOPHER	Thomomys bottae	GEOMYIDAE		
M105	CALIFORNIA KANGAROO RAT	Dipodomys californicus	HETEROMYIDAE	6	
M112	BEAVER	Castor canadensis	CASTORIDAE		
M119	BRUSH MOUSE	Peromyscus boylii	CRICETIDAE		
M127	DUSKY-FOOTED WOODRAT	Neotoma fuscipes	CRICETIDAE	6	
M134	CALIFORNIA VOLE	Microtus californicus	CRICETIDAE	1 3 6	
M139	MUSKRAT	Ondatra zibethicus	CRICETIDAE		9
M142	HOUSE MOUSE	Mus musculus	MURIDAE		
M145	PORCUPINE	Erethizon dorsatum	ERETHIZONTIDAE		
M146	COYOTE	Canis latrans	CANIDAE		9
M149	GRAY FOX	Urocyon cinereoargenteus	CANIDAE		9
M152	RINGTAIL	Bassariscus astutus	PROCYONIDAE	5	
M153	RACCOON	Procyon lotor	PROCYONIDAE		9
M155	FISHER	Martes pennanti	MUSTELIDAE	6	
M156	ERMINE	Mustela erminea	MUSTELIDAE		9
M160	BADGER	Taxidea taxus	MUSTELIDAE	6	9
M162	STRIPED SKUNK	Mephitis mephitis	MUSTELIDAE		9
M163	RIVER OTTER	Lutra canadensis	MUSTELIDAE	6	
M165	MOUNTAIN LION	Felis concolor	FELIDAE	6	
M166	BOBCAT	Felis rufus	FELIDAE		9
M177	ELK	Cervus elaphus	CERVIDAE		9
M181	MULE DEER	Odocoileus hemionus	CERVIDAE		9
R004	WESTERN POND TURTLE	Clemmys marmorata	EMYDIDAE		
R022	WESTERN FENCE LIZARD	Sceloporus occidentalis	IGUANIDAE		

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R042	NORTHERN ALLIGATOR LIZARD	Gerrhonotus coeruleus	ANGUIDAE		
R062	WESTERN TERRESTRIAL GARTER SNAKE	Thamnophis elegans	COLUBRIDAE		
R063	WESTERN AQUATIC GARTER SNAKE	Thamnophis couchi	COLUBRIDAE		

TOTAL SPECIES: 113

Status Definitions:

1. FE: Federally Endangered
2. FT: Federally Threatened
3. CE: California Endangered
4. CT: California Threatened
5. CP: California Protected
6. CS: California Special Concern
7. FS: Forest Service Sensitive
8. BS: BLM Sensitive
9. H : Harvest

CPS: Candidate or Proposed Candidate Species

APPENDIX V

Boggs Lake

Vascular Plant List

PARTIAL LISTING OF THE PLANTS
OF
BOGGS LAKE PRESERVE

Scientific Name	Common Name
ALISMATACEAE (WATER-PLANTAIN)	
Sagittaria cuneata	Arrowhead
AMARANTHACEAE	
Amaranthus californica	Amaranth
AMARYLLIDACEAE (AMARYLLIS)	
Allium amplectens	Paper Onion
Allium lacunosum	
Brodiaea congesta Sm.	Ookow
Brodiaea coronaria	Harvest Brodiaea
Brodiaea hyacinthina	White Brodiaea
ANACARDIACEAE (SUMAC)	
Toxicodendron diversilobum	Poison Oak
APIACEAE (CARROT)	
Daucus pusillus	Rattlesnake weed
Eryngium aristulatum	Coyote Thistle
Osmorhiza chilensis	Sweet Cicely
Perideridia kelloggii	Kellogg's Yampah
Sanicula bipinnatifida	Snake Root
Scandix pecten-veneris	Shepherd's Needle
Torilis japonica (Houtt) D.C.	Hedge Parsley
APOCYNACEAE (DOGBANE)	
Apocynum pumilum	
ASCLEPIADACEAE (MILKWEED)	
Asclepias fascicularis	Milkweed
ASPIDIACEAE	
Polystichum munitum	Sword Fern
ASTERACEAE (SUNFLOWER)	
Achillea lanulosa	Yarrow
Adenocaulon bicolor	Trail Plant
Agoseris grandiflora	Mountain Dandelion
Agoseris heterophylla	Woodland Agroseris
Artemisia douglasiana	Sagebrush
Cirsium coulteri	Thistle
Gnaphalium palustre	Cudweed
Hemizonia luzlaefolia	Tarweed
Hieracium albiflorum	Hawkweed
Hypochoeris radicata	Cat's Ear
Lactuca serriola	Prickly Lettuce
Lagophylla dichotoma	
Lasthenia chysostoma	Gold Fields
Lasthenia glabrata	Smooth Lasthenia
Madia exigua	Pygmy Madia
Micropus californicus	

Scientific Name	Common Name
Microseris douglasii	Douglas's Microseris
Psilocarphus brevissimus	Wooly Marbles
Psilocarphus oregonus	
Rigiopappus leptocladus	
Solidago canadensis ssp. elongata	Goldenrod
Wyethia angustifolia	Narrowleaf Mule Ears
BORAGINACEAE (BORAGE)	
Pectocarya pusilla	
Plagiobothrys stipitatus	
Plagiobothrys undulatus	
BRASSICAEAE (MUSTARD)	
Athysanus pusillus	
Draba verna	Whitlow-grass
Rorippa curvisiliqua	Yellow Cress
CALLITRICHACEAE	
Callitriche hermaphroditica	
Callitriche marginata	
Callitriche verna	
CAMPANULACEAE (BELLFLOWER)	
Downingia bella	
Downingia bicornuta	Two-horned Downingia
Downingia cuspidata	Toothed Downingia
Downingia pulchella	Valley Downingia
Githopsis specularioides	Common Blue Cup
Heterocodon rariflorum	
Legenere limosa	
Nemocladus capillaris	
CAPRIFOLIACEAE (HONEYSUCKLE)	
Lonicera interrupta	Honeysuckle
Symphoricarpos acutus	Snowberry
CARYOPHYLLACEAE (PINK)	
Arenaria californica	
Cerastium viscosum	Mouse-ear Chickweed
Minuartia douglasii	Sandwort
Silene californica	Catchfly
Stellaria nitens	Chickweed
CONVOLVULACEAE (MORNING-GLORY)	
Calystegia malacophyllus	Sierra Morning Glory
Calystegia subacaulis	Hill Morning Glory
CORNACEAE (DOGWOOD)	
Cornus nuttalii	Mountain Dogwood
CRASSULACEAE (STONECROP)	
Tillaea aquatica	Pigmy-weed

Scientific Name	Common Name
CUSCUTACEAE (DODDER)	
Cuscuta howelliana	
Linanthus bakeri	Bakers Linanthus
CYPERACEAE (SEDGE)	
Cyperus aristatus	
Eleocharis acicularis var. bella	Spike Rush
Eleocharis obtusa	
Eleocharis palustris	
Scirpus acutus	Common Tule
ELATINACEAE (WATERWORT)	
Elatine brachysperma	
Elatine calfornica	
Elatine heterandra	
Elatine obovata	
ERICACEAE (HEATH)	
Arbutus menziesii	Madrone
Arctostaphylos spp.	Manzanita
EUPHORBIACEAE (SPURGE)	
Hemocarpus setigerus	Doveweed
FABACEAE (PEA)	
Astragalus gambelianus	Gambell's Dwarf Locoweed
Lotus crassifolius	Buck Lotus
Lotus hamatus	
Lotus humistratus	Hill Lotus
Lotus purshianus	Spanish Lotus
Lupinus albifrons	
Lupinus bicolor	Minature Lupine
Melilotus albus	Sweet Clover
Psoralea physodes	California Tea
Trifolium ciliolatum	
Trifolium depauperatum	Balloon Clover
Trifolium dichotomum	
Trifolium microcephalum	Maiden Clover
Trifolium microdon	
Trifolium trichocalx	
Trifolium tridentata	Tomcat Clover
FAGACEAE (BEECH)	
Quercus chrysoleois	Caynon Oak
Quercus kellogii	California Balck Oak
GENTIANCEAE (GENTIAN)	
Centaurium davyi	Centaury
GERANIACEAE (GERANIUM)	
Erodium cicutarium	Redstem Storksbill

Scientific Name	Common Name
HALORAGACEAE	
Myriophyllum hippurioides	Water Milfoil
HEPATICAE (LIVERWORTS)	
Porella platyphylla	
HYDROPHYLLACEAE (WATERLEAF)	
Nemophila maculata	Fivespot
Nemophila menziesii	Baby Blue Eyes
IRIDACEAE (IRIS)	
Iris douglasiana	Iris
Sisyrhinchium bellum	Blue-eyed-grass
ISOETACEAE (QUILLWORT)	
Isoetes howellii	Howell's Quillwort
JUNCACEAE (RUSH)	
Juncus balticus	
Juncus bufonius	Toad Rush
Juncus nevedensis	
LAMIACEAE (MINT)	
Monardella odoratissima	ssp. pinetorum
Pogogyne serpylloides	
Stachys ajugoides	Hedge-nettle
LAURACEAE (LAUREL)	
Umbellularia californica	California Bay/Laurel
LENTIBULARIACEAE (BLADDERWORT)	
Utricularia gibba	
Utricularia vulgaris	
LILAEACEAE	
Lilaea scilloides	Flowering Quillwort
LILIACEAE (LILY)	
Calochortus amabilis	Mariposa Lily
Calochortus superbus	
Disporum hookeri var. trachyandrum	Fairy Bells
Smilacina stellata var. sessifolia	False Solomon's Seal
LINACEAE (FLAX)	
Linum micranthum	
LYTHRACEAE (LOOSESTRIFE)	
Lythrum californicum	Common Native Loosestrife
Lythrum hyssopifolia	Hyssop Loosestrife
Rotala ramosior	Tooth-cup

ientific Name	Common Name
MARSILEACEAE	
Marsilea mucronata	
MARSILEASEAE	
Pilularia americana	Pillwort
MUSCI (MOSSES)	
Dendroalsia abietina	
NYMPHACEAE (WATER-LILY)	
Brasenia schreberi	Water-shield
ONAGRACEAE (EVENING-PRIMROSE)	
Boisduvalia cleistogama	
Boisduvalia glabella	
Clarkia affinis	
Clarkia purpurea	Winecup Clarkia
Clarkia rhomboidea	Tongue Clarkia
Ludwigia palustris var. pacifica	
ORCHIDACEAE (ORCHID)	
Habenaria elegans	Elegant Habenaria
PINACEAE (PINE)	
ıus attenuata	Knobcone Pine
Pinus ponderosa	Yellow Pine
Pseudotsuga menziesii	Douglas Fir
PLANTAGINACEAEA	
Plantago hookeriana var californica	
POACAEA	
Vulpia myuros	Festuca myuros
POACEAE	
Aira carrophyllea	Hairgrass
Alopercuris geniculatus	Foxtail
Alopercuris howellii	
Briza minor	Quaking grass
Bromus carinatus	California Brome
Bromus diandrus	
Bromus mollis	Soft Chess
Bromus rubens	Foxtail Chess
Bromus tectorum	Cheat Grass
Deschampsia danthonoides	
Deschampsia elongata	
Elymus glaucus	Rye Grass
Festuca megalura	Foxtail Fescue
Festuca microstachys	
Festuca reflexa	
yceria elata	Manna grass
Hordeum jubatum	Foxtail

Scientific Name	Common Name
Monerma cylindrica	
Orcuttia tenuis	
Poa bolanderia var. howellii	Bluegrass
Polypogon maritimus	Beard Grass
Scribneria bolanderi	
Sitanion jubatum	
Taeniatherum asperum	
POLEMONIACEAE	
Collomia heterophylla	(Dougl. ex Hook.)
Linanthes bakeri	Baker's Linanthus
Linanthes bolanderi	
Linanthes ciliatus	Whisker Brush
Navarretia divaricata ssp. vividior	
Navarretia intertexta	Needle Navarretia
Navarretia mellita	
Navarretia pauciflora	
Navarretia plieantha	
Navarretia subuligera	
Navarretia tagetina	
POLYGONACEAE (BUCKWHEAT)	
Eriogonum sp.	Wild Buckwheat
Polygonum arenastrum	
Polygonum californicum	
Polygonum coccineum	Water Smartweed
Polygonum kelloggii	
Polygonum parryi	
Polygonum sp.	Knotwheat
Rumex crispus	Curly Dock
Rumex transitorius	
PORTULACACEAE	
Calandrinia ciliata var. menziesii	Red Maids
Montia linearis	
Montia perfoliata	Miner's Lettuce
Montia spathulata var. exigua	Linear Montia
Portulaca sp.	Pinweed
POTAMOGETONACEAE (POND WEED)	
Potamogeton diversifolius	
Potamogeton foliosus	Leafy Pondweed
PTERIDACEAE	
Pteridium aquilinum var pubescens	Bracken Fern
PYROLACEAE (WINTERGREEN)	
Chimaphila menziesii	Pipsissewa
RANUNCULACEAE (CROWFOOT)	
Aquilegia formosa var. truncata	Columbine
Myosurus minimus	Mouse Tail

Scientific Name	Common Name
nunculus flammula var. ovalis	
Ranunculus hebecarpus (H & A)	
Ranunculus lobbii	Lobb's Buttercup
Ranunculus occidentalis	Western Buttercup
RHAMNACEAE (BUCHTHORN)	
Ceanothus integerrimus	var. californica (Deer Bush)
RHAMNACEAE (BUCKTHORN)	
Rhamnus californica	Coffeeberry
ROSACEAE (ROSE)	
Cercocarpus betuloides	Mountain Mahogany
Heteromeles arbutifolia	Christmas Berry
Holodiscus discolor	Cream Bush
Horkelia bolanderi	
Rosa californica	
Rosa pinetorum	
Rubus sp.	Blackberry/Rasberry
RUBAICAEAE (MADDER)	
Galium aparine	Bedstraw
Galium bolanderi Gray	
Galium californicum	
SCROPHULARIACEAE	
llinsia parviflora	Maiden Blue-eyed Mary
Collinsia rattanii	Sticky Blue-eyed Mary
Collinsia sparsiflora	Spinsters Blue-eyed Mary
Gratiola ebracteata	
Gratiola heterosepala	
Mimulus tricolor	Monkey-Flower
Orthocarpus attenuatus	Narrow-leaved Owl Clover
Orthocarpus campestris	Field Owl Clover
Orthocarpus erianthus	Butter and Eggs
Orthocarpus lithospermoides	Cream Sacs
Pedicularis densiflorus	Indian Warrior
Penstemon heterophyllus ssp. purdyi	Beard-tongue
Verbascum thapsus	Common Mullein
Veronica perigrina	Speedwell
SCROPHULARICAEAE	
Lindernia anagallidea	False Pimpernel
VALERIANACEAE	
Plectritis ciliosa	Long-spurred Plectritis
Plectritis congesta	Short-spurred Plectritis
VERBENACEAE	
Verbena lasiostachys	Western Verbena
VIOLACEAE (VIOLET)	
..ola quercetorum	

APPENDIX VI

Rare Plant Monitoring Report for Boggs Lake, 1991

REPORT ON ANNUAL MONITORING OF RARE PLANTS AT THE NATURE CONSERVANCY'S BOGGS LAKE PRESERVE FOR 1991

BY
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CONTENTS

RESULTS

Two objectives determined the character of the plant-monitoring at the Boggs Lake Preserve as well as the nature of this report. These were to ascertain the current status of the rare and endangered species, or "element-species", and to record significant changes in the total vegetation at the preserve, if any. The rare plants of particular concern were the many-flowered navarretia (Navarretia plieantha: CNPS List 1B, code: NAPL), the slender orcutt grass (Orcuttia tenuis: CNPS List 1B, code: ORTE), and the Boggs Lake hedge-hyssop (Gratiola heterosepala: CNPS List 1B, code: GRHE). In 1991 the first two of these species, NAPL and ORTE, were fairly common in their usual sites at the lake-bottom or adjacent meadow. The third species, GRHE, was probably absent, for just as in 1989 and 1990 we were unable to find it. A fourth element-species was Bolander's horkelia (Horkelia bolanderi, var. bolanderi: CNPS List 3) not specially monitored because it occurred abundantly in the grassland and mixed-forest strip at the periphery of the vernal pool zone. Thus the "element-species group" referred to beyond consists only of NAPL and ORTE. In addition to the three element-species, 105 other non-element species were recorded at the monitoring sites in 1991 (see table 6, p. 13).

Status of Navarretia plieantha in 1991

Rank: G1 S1.1 Federal listing: D State listing: E

The many-flowered navarretia occurred especially at the higher marginal parts of the exposed lake-bed and, by now, far toward the center. Also, NAPL occupied low, seasonally ponded or wet places in the adjacent meadow. Statistics pertaining to NAPL are given in table 1, p. 9.

Under "prominence," we have tried to estimate the role of NAPL in adding diversity to the vernal pool plant community. This figure represents a proportion, or ratio, and is derived by dividing the occurrences of NAPL by the total of occurrences of all species. The statistic is based on the Shannon index of diversity (see: A.E. Magurran, 1988, Ecological diversity and its measurement, Princeton, 179 pp., for practical discussion of the Shannon index). The "prominence" is affected by any change in either number of species present or in species abundances.

At the preserve as a whole, NAPL gained slightly in 1991 over 1990 in "prominence," with a rise of 7% of the 1990 value. Nevertheless, the success of NAPL varied regionally within the preserve, the south sector showing the strongest gain, i.e., by 35% of the 1990 value. This was conspicuous in the field. The meadow was weakest of all the regions, with a 26% decline.

The second measure in table 1 is percent species composition, i.e., again the recorded number of occurrences of NAPL divided by the sum of occurrences of all species present. Here, however, we take the resulting ratio itself as a statement of the proportion of this species to that of all other species, rather than as a factor affecting diversity. At the lake all values of species-composition increased by 6% to 26% over 1990 values, but at the meadow NAPL lost to other species by 15%.

The third measure is percent plot-frequency, or the number of occurrences divided by the number of 50x50 cm sample-plot counts. Plot-frequency values for NAPL increased strongly at the lake, the greatest gain being made at the east sector, where plot-frequency rose from 43.5% in 1990 to 72.6% in 1991, or by 77%. At the meadow a slight gain of 5% of the 1990 value was seen.

Both at the lake and the meadow the plants were uniformly small in 1991, with the average height of entire plants about one-half inch at the first monitoring in June.

Plant-density was recorded as number of plants per 25x25 cm plot, i.e., by using only square #2 of the nested frequency sampling template (see fig. 1, p. 17) at plots positive for NAPL. At the lake, density of NAPL plants

rose from 30.4 to 47.5 plants per plot, or by 56%, from 1990 to 1991. At the meadow a moderate decline of 19% occurred.

Flowerhead-density at the lake was 47.5 flowerheads per 25x25 cm plot, up from 1990, but at the meadow it was 32.2, down from 1990. Throughout the preserve, flowerhead density per plant was approximately one head per plant, as multi-headed plants were too few to show up in the statistics reported.

Status of Orcuttia tenuis in 1991

Rank: G2 S2.1 Federal listing: C State listing: E

The overall "prominence" of the slender orcutt grass at the lake doubled in 1991, the ratio rising from 0.012 in 1990 to 0.024. This means ORTE's share in the diversity of the lake-bottom vegetation rose from 1.2% in 1990 to 2.4% in 1991, an 100% increase (see table 2, p. 10). Both the species-composition and the plot-frequency percentages underwent even larger increases. This suggests a more widespread occupation within its usual habitat in 1991. Corroboration is seen in the following data: In 1990, ORTE was recorded in 20 out of 432 sample-plot counts, or 4.6%, whereas in 1991, ORTE was recorded in 65 out of 450 sample-plot counts, or 14.4%. This represents an increase in occupancy of available sites by 213% over 1990.

Despite the wider distribution of ORTE in 1991, the plant-density of ORTE at the lake decreased considerably in 1991 from that of 1990, i.e., by an average 6.0 versus 18.3 plants per plot, a decline of 67%. Inflorescences per plant were quite low at the lake as compared to 1990, i.e., 0.57 in 1991 versus 1.2 in 1990. On June 26, 1991, the height of ORTE plants averaged almost two inches, far less than in previous years, and the largest seen was about 3.5 inches (inflorescence included in all). Lateness of season for ORTE in 1991 may have exaggerated the difference in our monitoring results for the two years.

We watched the changes in level of the water-surface at the lake through the winter and spring months of 1990 to 1991. At no time did the water surface reach up to the higher levels where ORTE later germinated and grew. The only standing water at the higher sites would have been from rainfall and of very temporary duration.

Change in environment, 1990 to 1991

Rainfall at Boggs Lake Preserve from July 1990 through

June 1991 was 30.1 inches (table 3, p. 11) as received in our raingage at the meadow. This is 2.3 inches less than for the corresponding period from 1989 to 1990 and 0.3 inches more than for the same period from 1988 to 1989.

In 1990 to 1991, 22.7 inches, or 75% of the total, fell during February and March, whereas in April, May and June only 2.4 inches, or 7.9% of the total, were added. This contrasts with the previous ecoyear (July '90 through June '91), when 5.7 inches, or 17.7% of the total, fell during February and March and 6.3 inches, or 19.3% of the total, were added in April and May. We could characterize the 1990-91 ecoyear as relatively wet in February and March but relatively dry in April, May and June.

Water-levels at the lake from July 1990 through June 1991 (table 4, p. 11) were exceptionally low. In March, the wettest month of the year, the water-surface was more than eight ft. below the 1983 high-water mark of the lake. The last bit of standing water at the ponds within the tules disappeared during the first week of August.

Weeds remained a problem at the lake. Even though a great many star-thistles and cirsium thistles were pulled out in summer 1990, such thistles were back in large numbers within the preserve in 1991.

The purplish-flowered cirsium thistle, Cirsium callilepis, had now moved from the periphery onto the vernal plain on the northwest side of the lake at quadrats 5, 6, 7 and 8. In August 1991, the star-thistle, Centaurea solstitialis, was also seen at these same quadrats, abundantly at quadrat 5. We have been told these last were being eradicated in August 1991 by a volunteer, when an underground yellow-jacket nest was disturbed with unhappy consequences.

In June 1991, we noted a previously undetected weed established at the northeast side of the lake, near rebar 13D. The weed closely resembled the star-thistle but produced shorter spines. It turned out to be a close relative, the tocalote, Centaurea melitensis.

As has happened in two of the past four years, starts from seed of the narrow-leaved cattail, not an established plant-species at the preserve, appeared at several spots in quadrat 23 of the exposed lake-bed. We dug out these starts because all vernal pool species could be displaced by them. Further, in 1991 an uncommon, new seed-start of the tule (Scirpus) was found in the same area and destroyed for the same reason.

Trends during the five years, 1987 to 1991

In 1987, monitoring activity was expanded to include

most of the exposed lake-bed and the adjacent meadow to the west. With the 1991 monitoring, data are now at hand covering five consecutive years of the expanded monitoring. We may start looking for "trends," an important objective of the monitoring.

A compact summary of the five-year data is presented in table 5, p. 12. The reader may run his eye down each column seeking a pattern. Do the figures increase, decrease or show other tendencies over the period? Let's take the parameters in turn!

For "prominence," inspection of the yearly ratios yields a strong impression that NAFL produced a pattern of distinct increase at the lake-bed but an up-and-down pattern at the meadow. For ORTE, occurring only at the lake, a pattern of distinct decrease seems evident.

For species-composition, one sees mostly year-to-year increases for NAFL at the lake but mainly decreases at the meadow. For ORTE, the pattern appears one of yearly decreases only.

For plot-frequency, NAFL at the lake shows consistent percentage increases, one year excepted, while at the meadow decreases occurred for three of the years and an increase for one. With ORTE, the percentages decreased in two of the years but increased in the other two, yet the values show a general decrease in gross magnitude over the 5-year period.

Although this period of time is very brief, we can certainly see something happening to these element species. They are increasing or decreasing; and their populations must be changing in relation to those of other species in the community and to the plant-community as a whole. In the most consistent cases we may well be justified in considering these effects as short-term trends. But still, they appear susceptible to redirection by random, minor environmental variations. It seems best to avoid thinking of them as consistent, inexorable shifts not perceptibly readjusted by every perturbation within the environment.

Should we view these short-term changes in the vegetation of the preserve as responses to a progression from wet to dry environmental conditions? Has such a progression actually occurred? Data gathered at the preserve over these years of monthly rainfall and of water-levels of the lake should give some basis for a judgment on this question; therefore, 5-year summaries of rainfall and water-levels are given in tables 8 and 9, page 16.

The rainfall data are not easy to interpret. However, the stark fact that the lake-bottom was essentially dry

during the last two summers, i.e., 1989 and 1990, seems persuasive, especially when it is realized the lake remained virtually full during the summers of 1983 and 1984 and perhaps half full or more in the summers of 1985 and 1986, and probably less than that in 1987 and 1988. Unfortunately we have no measures of moisture held in the ground available to the annuals for germination and growth.

RECOMMENDATIONS

1. Weed control.

During the past two summers, star-thistles and purplish-flowered cirsium thistles have invaded the lake-bed and meadow, and they have reappeared in vigor again this year. We commend the heroic efforts by staff and volunteers to reduce these obnoxious invaders. Since these weeds are able to thrive under current conditions, yearly control work will surely be advisable for a few years to come.

2. Special steps for salvage of vanishing species?

Continued thought should be given as to how to help element-species on the brink of extirpation from the preserve. At present the only threatened one is the Boggs Lake hedge-hyssop, GRHE. As mentioned earlier, this year we failed for the third successive summer to find the plant in its last-known locations or elsewhere. If any GRHE plants appear in the future, we plan to protect them immediately from deer-browsing, which is invariably severe in the wet strip where the vernal pool annuals are germinating and attaining their first growth. We have ready two rolls of low wire mesh fencing to be set up around small groups of plants and closed off with chicken-wire cover. The small exclosures formed would be left in place until seeds have been released. The point is -- we should keep in mind these critical happenings and have specific measures of protection thought out to take. Had we realized this a few years ago, we might have insured that some of the last GRHE plants would have survived to produce seeds.

BACKGROUND

In 1991, two monitorings were made at each monitoring site. At the meadow these monitorings were on May 6 and June 7, and at the lake on May 19 and June 20, although all four monitorings required more than one day to complete. All field work was carried out by the authors of this

report.

All transects were in the same location as in previous years, but transects extending to the west-central part of the lake-bottom were shorter than in 1990 because of shallow standing water or wet ground near the tules in late spring.

A list of scientific names of all plant-species met at the transects is given in table 6, pp. 13 and 14. Also shown are codes used for the plants. In addition, "x's" tell at which monitoring(s) each plant-species was seen.

Various statistics describing the monitoring of 1991 as against the previous two years are shown in table 7, p. 15. The monitoring layouts for 1991 and the extent of sampling are to be seen in figures 2 and 3, p. 18 and 19.

An example of the field form showing initial handling of actual data is given as figure 1, p. 17.

Complete copies of the field data for 1991 are being deposited with The California Field Office, the Bay Area Preserves Office at Tiburon, and with the Boggs Lake Committee.

Table 1

Navarretia plieantha, 1991

Parameter	Preserve	Lake	North sector	East sectpr	South sector	Meadow
"Prominence" ratio, HC/HI,[1/]	.062 (+ 7%)	.071 (+16%)	.073 (+18%)	.081 (+ 4%)	.058 (+35%)	.038 (-26%)
Percent species-composition	7.2 (+13%)	8.7 (+26%)	8.5 (+47%)	9.5 (+ 6%)	6.4 (+19%)	4.7 (-15%)
Percent plot-frequency	42.7	58.7 (+66%)	47.5 (+77%)	72.6 (+67%)	46.6 (+48%)	57.7 (+ 5%)
Plant density	44.0 (+32%)	45.7 (+56%)	38.9 (-26%)	53.1(+130%)	46.6 (+65%)	32.2 (-19%)
Flowerhead density		47.5 (+56%)	39.3 (-28%)	53.4(+130%)	47.4 (+53%)	32.2 (-25%)
Flowerheads per plant		1.01(-4.7%)	1.01(-0.1%)	1.05(-1.0%)	1.02(+1.1%)	1.03(-4.6%)

1/ HC = Natural log (ln) of occurrences of NAPL (ORTE), i.e., "H-component (HC),"
HI = Index of diversity (H'). See text, p. 3.
Parentheses = Percent change from 1990 to 1991, i.e., 1990 value minus 1991 value divided by 1990 value, times 100.

Table 2

Orcuttia tenuis, 1991

Parameter	Preserve	Lake	North sector	East sector	South sector	Meadow
"Prominence" ratio, HC/HI[1/]	.017 (+89%)	.024(+100%)	.050(+100%)	.022(+100%)	0	0
Percent species-composition		2.2(+144%)	4.4(+159%)	1.8(+100%)	0	0
Percent plot-frequency		14.4(+213%)	24.6(+200%)	12.5(+198%)	0	0
Plant-density		6.0 (-67%)	3.6 (-87%)	15.6(+420%)		
Flowerhead density		6.0 (-73%)	1.9 (-95%)	9.4(+488%)		
Flowerheads per plant		0.57 (-50%)	0.52 (-62%)	0.61 (+20%)		

1/ See table 1.

Table 3

Rainfall at Boggs Lake Preserve, 7/90 - 6/91

Month	Total recorded for month, in.	Cumulative total for eco-year, in.
July '90	0	0
Aug.	trace	0
Sept.	0.76	0.76
Oct.	1.25	2.01
Nov.	0.82	2.83
Dec.	1.51	4.34
Jan. '91	0.76	5.10
Feb.	4.44	9.54
Mar.	18.21	27.75
Apr.	0.98	28.73
May	0.77	29.50
June	0.64	30.14

Table 4

Water-levels at Boggs Lake, 7/90 - 6/91

Month	Month-end water-levels*	Effect
July '90	0	Lake dry
Aug.	0	"
Sept.	0	"
Oct.	0	"
Nov.	0	"
Dec.	0	"
Jan. '91	0	Damp (water not far below)
Feb.	0	"
Mar.	27" (39" at deepest places)	Standing water in deepest Places)
Apr.	20" (32" at deepest)	"
May	13" (25" ")	"
June	0 at top of tule roots	Standing water limited to deep spots within and edging tules

* Inches above highest tule roots at end of floating dock

Table 5

Comparison of monitoring results for years 1987 through 1991

Species	Locality	Year	"Prominence" ratio: HC/HI	Percent species-composition	Percent plot-frequency	Density of plants*	Density of flowerheads*	Flowerheads per plant
NAPL	Lake-margin	1987	0.040	3.9 %	13.4 %	10	14	0.71
		1988	0.054	5.0 %	26.9 %	15	22	0.68
		1989	0.061	6.5 %	34.7 %	39	41	0.95
		1990	0.061	6.9 %	34.2 %	30	32	0.94
		1991	0.071	8.7 %	56.7 %	48	48	1.00
NAPL	Meadow	1987	0.061	8.1 %	71.5 %	115	112	1.03
		1988	0.049	5.8 %	63.0 %	44	91	0.48
		1989	0.054	5.9 %	61.9 %	100	116	0.86
		1990	0.051	5.5 %	55.0 %	40	43	0.93
		1991	0.038	4.7 %	57.7 %	32	32	1.00
ORTE	Lake-margin	1987	0.066	7.5 %	26.0 %	26	33	0.79
		1988	0.051	5.4 %	29.0 %	19	18	1.06
		1989	0.033	3.4 %	18.3 %	9	9	1.00
		1990	0.012	0.9 %	4.6 %	18	22	0.82
		1991	0.024	2.2 %	14.4 %	6	6	1.00

* Density is expressed as number of plants or flowerheads (inflorescences) per 50 x 50 cm sample-plot positive for plants or flowerheads, in square #2 (see fig. 1).

Table 7. Extent of monitoring, 1987 to 1991

Parameter	Lake					Meadow				
	1991	1990	1989	1988	1987	1991	1990	1989	1988	1987
Total no. of transects used	18	18	18	18	16	6	6	6	6	6
Tot. no. of transect-counts made	36	36	36	35	28	12	12	12	12	12
Tot. no. of nested-frequency samples	450	438	415	334	259	137	140	147	132	186
Av. no. of 50 x 50 cm plot-samples per transect-count	13	12	12	10	9	11	12	12	11	16
Tot. no. of plant-species recorded in the samples	82	75	77	69	44	68	61	69	63	54
Av. no. of plant-species recorded per transect-count	20	19	20	17	12	33	27	31	28	24
Av. no. of plant-species recorded per sample	7	5	5	5		12	10	10	12	

Table 8. Rainfall over five years, 1987-1991

Year	January to June: Rainfall, in.	Rainfall per mo., in.	Rainiest month in first half of year, and amount, in.		Early vs. late rainfall, in.: Jan.-Mar.	Apr.-June
1987	22.17	3.70	March	9.34	21.8	0.40
1988	15.23	2.54	January	8.18	10.2	5.06
1989	19.79	3.30	March	13.73	16.7	3.05
1990	20.42	3.40	January	8.43	14.2	6.25
1991	25.80	4.30	March	18.41	23.41	2.39

Table 9. Water-levels at the lake, 1987-1991, measured as inches above bottom

Year	March	April	May	June	July
1987	54	49	42	33	26
1988	45	40	32	30	8
1989	118	43	85	42	28
1990	27	23	20	15	12
1991	27	20	13	0	0

BOGGS E PRESERVE

Study Name: Rare Plant Monitoring, Year: 1991 First: Second: X Date June 26, 1991

Site: Lakeshore, North sector Transect No. E Sheet # 1 of 1 sheets

Method: Nested Frequency. Distance between samples: 15 meters. Start sampling at: 1m W, 3m S of V-ND

Species	Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Score 1	2	3	4	% Plot Freq. 1	2	3	4	No. Occur	% Comp	H-component
ERAR	2	1	2	2	1	1	3	2	1	1	1	1	2	1	1	2	9	6	1					100	16	22.9	-0.337
FEME	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			1					6	1	1.4	.061
NAPL	1	1	1	1	1	–	1	1	1	1	2	–	–	–	–	–	9	1						63	10	14.3	.278
ELMA	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	1						19	3	4.3	.135
DEDA	1	3	3	2	2	–	–	–	–	–	–	–	–	–	–	3	1	2	3					38	6	8.6	.211
AGHE	2	2	–	–	2	–	–	–	–	–	–	–	–	–	–	–		3						19	3	4.3	.135
AICA	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		1						6	1	1.4	.061
VEPE	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	4	1	1		1				19	3	4.3	.135
PLST	2	–	2	2	–	–	–	3	–	3	3	–	–	–	–	–		3	3					38	6	8.6	.211
ORTE	–	–	–	–	–	–	–	–	–	4	–	2	1	2	1	–	2	2		1				31	5	7.1	.189
CLPU	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–		1						6	1	1.4	.061
BOCL	–	4	–	–	2	–	–	–	–	–	–	–	–	–	–	–		1		1				13	2	2.9	.102
HYRA	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–		1						6	1	1.4	.061
HELU	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–		1						"	1	"	"
CRAQ	–	–	–	–	–	–	–	–	–	–	–	2	1	2	2	–	1	3						25	4	5.7	.164
ISHO	–	–	–	–	–	–	–	–	–	–	–	–	2	2	1	2	1	3						"	4	"	"
ELAC	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4		1		1				13	2	2.9	.102
DOBI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1		1							6	1	1.4	.061

Plot Square 2 — Density & Vigor

		Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Σ
NAPL	No. plants	200	140	56	24	100	–	42	8	7	50	5	–	–	–	–	–	
	No. Infl's	200	140	10	24	100	–	42	8	7	50	5	–	–	–	–	–	
ORTE	No. plants	–	–	–	–	–	–	–	–	–	–	–	1	4	3	14	–	
	No. Infl's	–	–	–	–	–	–	–	–	–	–	–	1	4	2	9	–	

Ground Cover	Veg.	Lit.	Rock	Pave.	Moss	Soil	Water
Dot Tally	⁘	⊠ ⁘				⊠ ⊠ ⊠ ⁘	
Total points	4	14				33	

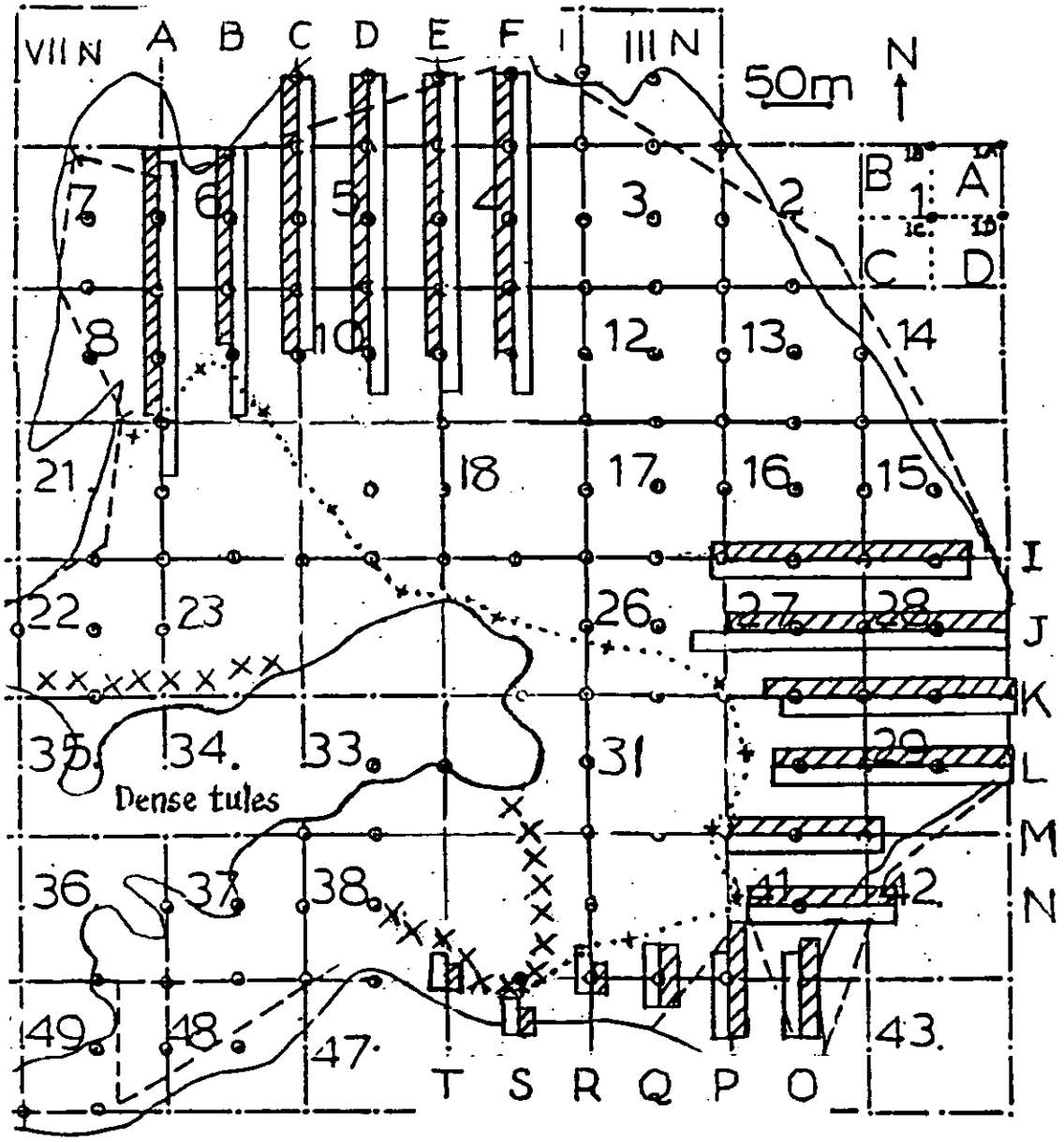
No. of samples: 16
No. of species: 18
Other species seen:
Σ points: 51

Σ 70 H = 2.529 or 2.53

Conducted by: PHB, SCB

Fig. 1. Form for field data as used in 1991

Fig. 2. Layout of transects at Boggs Lake in 1991



RECORD OF 1991 MONITORING AT THE LAKE

First monitoring, May 19. Transects used, number of nested-frequency samples (i.e., 50 x 50 cm sample-plots) taken, and spacing of the sample-plots along each transect line:

Transects	No. of n-f samples	Distance apart, m
A,B,C,D,E,F	13,10,16,16,16,16	15,15,15,15,15,16
I,J,K,L,M,N	13,14,16,15,12,13	15,15,12,12,10,8.5
O,P,Q,R,S,T	7,10, 8, 8, 8, 9	10,10,7,2.5,2.5,2.5

Second monitoring, June 20.

Transects	No. of n-f samples	Distance apart, m
A,B,C,D,E,F	16,14,14,16,16,16	15,15,15,15,15,15
I,J,K,L,M,N	13,16,15,15,13,13	15,15,12,12,10,10
O,P,Q,R,S,T	7,10, 8, 9, 9,10	10,10,7,2.5,2.5,3

Symbols:

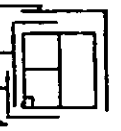
Transects used in first monitoring, May 19, 1991

Transects used in second monitoring, June 20, 1991

+····+··· Position of water-edge, May 19.

XXXXX " " " , June 20.

The nested-frequency template:



Entry of n-f data on n-f form:

If plant occurs in sq 1, enter "1".

If plant 1st found in sq 2, enter "2".

If plant 1st found in upper ½ of sq 3, enter "3".

If plant 1st found in rt. ½ of sq 4, enter "4".

Fig. 3. Layout of transects at meadow, 1991

The six transects are perpendicular to the baseline. The baseline runs west and east, the east end being a large pine tree with nail at base. The 100-meter grid is not installed at this time.

Transect	Site*	Length of trans,	No. of samp's taken	Dist. btw. samp.
May 6, 1991				
Tr. 1	30m	27m	10	3m
2	39	41	11	4
3	57	70	15	5
4	77	70	15	5
5	82.5	40	9	5
6	97	45	10	5
June 7,1991				
Tr. 1	30m	27m	10	3m
2	40	30	11	3
3	55	65	14	5
4	75	60	13	5
5	81.5	40	9	5
6	95	45	10	5

* Meters west of nail in gnd.