FINAL REPORT:

CHARACTERIZATION OF THE HABITAT FOR *LILAEOPSIS MASONII* (UMBELLIFERAE): A CALIFORNIA STATE-LISTED RARE PLANT SPECIES

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I. EXECUTIVE SUMMARY

To investigate the habitat characteristics of *Lilaeopsis masonii* Mathias & Constance (*Lilaeopsis masonii*), field reconnaissance of the physical and biological characteristics within the littoral zones of the Sacramento-San Joaquin Delta and the Napa River estuary was initiated. The report summarizes briefly the results of the field reconnaissance for the 39 locations as recorded by the California Natural Diversity Data Base.

Twenty-seven (27) known locations were surveyed in detail, while an additional three were observed without landing a boat, due to treacherous field conditions. Three known populations could not be relocated from the location descriptions in Natural Diversity Data Base files. Over 20 new locations are documented.

Lilaeopsis masonii grows most frequently on a clay substrate with a high organic matter content. Common plant associates in the littoral zone include *Scirpus californicus, S. cernuus* var. *californicus*, and *Hydrocotyle verticillata* var. *triradiata*. Common plant species found inland and adjacent to populations of *L. masonii* include *Scirpus californicus*, *Salix* spp., *Rubus procerus*, and *Polygonum persicaria*.

Many significant populations of *L. masonii* appear to be at risk, largely from human disturbance. Forms of disturbance include trampling from fishing and other human activities, erosion by wave action, disintegration of pilings, and potentially by sea level rising and water quality degradation. Significantly, those populations found within the Napa River drainage appear to be most threatened. However, the type locality of *L. masonii* presently is overgrown by invasive species and may be threatened by loss of shoreline.

It is recommended that additional surveys for *Lilaeopsis masonii* be conducted throughout the Sacramento-San Joaquin River confluence, and between the Napa River and the Delta region. Although this plant appears to establish short-lived populations by fragmentation, traveling to new sites by incoming and outgoing tides, followed by subsequent reestablishment both up- and down-stream, it remains extremely susceptible to habitat degradation. Following additional survey and documentation of *L. masonii*, a demographic analysis, coupled with a genetic survey, should be initiated to follow the extinction and founding dynamics of this unusual rare plant species.

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II. INTRODUCTION AND PROJECT OBJECTIVES

The Endangered Plant Program (EPP) of the state of California's Department of Fish and Game (CDFG) requested that the habitat of *Lilaeopsis masonii* (*Lilaeopsis masonii*) be documented and potential suitable habitat of this state-listed rare species be surveyed for unrecorded populations. Therefore, the purposes of this project were: (1) to document and describe generally the physical and biological characteristics of all recorded locations of *Lilaeopsis masonii*; (2) to survey suitable habitat for new populations of *Lilaeopsis masonii*; and, (3) to document and describe generally the habitat of newly recorded populations of *Lilaeopsis masonii*.

III. METHODS

Field reconnaissance began on June 5, 1990 and ended on March 22, 1991. The survey was conducted by boat[1] or by car. Populations were located initially on U.S.G.S. 7.5" minute topographic quadrangles (quads), and then ground surveyed. Each location was described in detail on site, mapped on 7.5" quads, and (usually) photographed; water chemistry and habitat data were also recorded. Vegetation data recorded included the plant species associated with *L. masonii* within the littoral zone, as well as those plant species found behind the littoral zone as part of the near shore habitat. Plants were keyed in Mason (1969) or Munz (1973). Plant nomenclature follows Munz. All plants recorded during this survey are listed in Appendix C.

General population statistics, *e.g.*, length and width of the population, were recorded where feasible. Water chemistry data at low tide were recorded with a YSI salinity, conductivity and temperature meter, model no. 33 S-C-T. These statistics include water temperature, salinity, and conductivity. Water pH was recorded with a hand-held pH meter (model no. HI8114 and probe no. HI1111) at low tide. The data sheet used to record all statistics during this study is included as Appendix D. Completed data sheets are included as Appendix E.

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[1]The boat used was an 17 ft Boston Whaler with a 70 horsepower outboard motor. In the shallower upper reaches a 14 ft skiff with a 25 horsepower outboard motor was used. Both boats are research vessels registered to San Francisco State University.

IV. RESULTS

IV.A. Species Description

Lilaeopsis masonii Mathias & Constance (Mathias & Constance 1977), is a member of the Apiaceae (Umbelliferae). *Lilaeopsis masonii* is a short, herbaceous perennial that spreads laterally by rhizomatous growth (Figure 1, Plate 1[2]). The leaves form tufts borne along the horizontal rhizome or at the apex of vertical rhizome branches. They vary in length, from 1.5 to 7.5 (-15.0) cm long, and from (0.2-) 0.4 to1.2 mm wide. They are terete, linear, or filiform, and bear septa not easily seen unless held up to the light. The small white to greenish flowers occur in simple umbels, bearing 3-8 flowers per umbel. The flowering period is between April and October with the fruits maturing between June to October (Affolter 1985).

With regard to its protection status, *Lilaeopsis masonii* is currently listed as Rare by the state of California (California Department of Fish and Game 1990), and is a Category 2 candidate for federal listing by the U.S. Fish and Wildlife Service. It is also included on the California Native Plant Society's list 1B, plants that are rare, threatened, or endangered in California or elsewhere (Smith and Berg 1988).

IV.B. Known Populations Surveyed

We surveyed 30 of the 39 known occurrences listed in the California Natural Diversity Data Base (CNDDB). The status of these locations is described in Table 1. Twenty-seven locations (27) were thoroughly examined; an additional three (3) locations were observed from the boat, but no data were taken. Conditions were too dangerous to land a boat at these three sites and they were inaccessible by car. The presence of *Lilaeopsis masonii* was confirmed by sighting, usually with binoculars. We were unable to locate CNDDB occurrence #'s 26, 29, and 30, and we are

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[2]All figures referred to within the text are found in Appendix A. All color plates referred to within the text are found in Appendix B.

Table 1. Survey Status of the California Natural Diversity Data Base Locations for *Lilaeopsis masonii*.

LOCATION (CNDDB OCC.#)	STATUS	ACCESSIBILITY
1- Antioch Dunes	Surveyed	Car
2- Collinsville	Surveyed	Car
3- Collinsville	Surveyed	Car
4- Collinsville	Surveyed	Car
5- Montezuma Island	Surveyed	Boat
6- Tolands Landing	Surveyed	Boat
7- Sherman Island (Type Locality)	Uncertain	Boat/Car
8- Antioch Bridge	Surveyed	Car
9- Antioch Bridge	Surveyed	Car
10- Napa River	Surveyed	Car
11- Suisun Marsh	Not Surveyed	Boat
12- Sherman Island	Not Surveyed	Car
13- Donlon Island	Observed	Boat
14- Sherman Island	Not Surveyed	Boat
15- Chain Island	Surveyed	Boat
16- West Sherman Island	Surveyed	Boat
17- West Sherman Island	Surveyed	Boat
18- Hill Slough	Surveyed	Boat
19- PG&E Picnic Area	Surveyed	Boat
20- San Joaquin River (14 Mile)	Not Surveyed	Boat/Car?
21- Browns Island	Surveyed	Boat
22- Frank's Tract	Not Surveyed	Boat
23- Brannan Island	Surveyed	Car
24- Winter Island	Surveyed	Boat
25- Peter's Pocket	Not Surveyed	Boat/Car?
26- Steamboat Slough	Unable to Locate	Boat
27- Miner Slough	Surveyed	Boat
28- Suisun Slough	Not Surveyed	Boat
29- Woodward Island	Unable to Locate	Boat
30- Woodward Island	Unable to Locate	Boat
31- Contra Costa Canal Spillway	Surveyed	Car
32- Antioch Point	Surveyed	Car
33- Sherman Island	Observed	Boat
34- Donlon Island	Surveyed	Boat
35- Suscol Creek	Surveyed	Car
36- Napa River	Surveyed	Car
37- Brannan Island	Surveyed	Car
38- Brannan Island	Surveyed	Car
39- Brannan Island	Surveyed	Car

uncertain as to the exact location of the type locality (CNDDB # 7). In several cases, locations were poorly written or incorrectly described. In addition, many sites in the CNDDB have much larger ranges than previously documented. We were able to survey by boat and on foot at low tides many relatively inaccessible locations and thus increase the known distribution of many populations. Corrections to all occurrence records are included in this report.

IV.C. New Locations Recorded

Over 20 new locations for *Lilaeopsis masonii* are documented. Many of these locations have been documented on California Native Species (CNS) forms that are on file with the CNDDB, but several other populations are mentioned in a report prepared by ECOS, Inc. (1988), for the U.S. Bureau of Reclamation and the California Department of Water Resources (DWR) in a transplant study of *Lilaeopsis masonii*. It would appear from reviewing these documents that some of the more viable populations have only recently been discovered and documented. Also, several new locations have been reported for Frank's Tract (McCarten 1990). New sites are found in the following general areas: (1) Decker Island; (2) along the Sacramento river on the Rio Vista side just up the river from Rio Vista; (3) in Cache Slough; (4) on Donlon Island; (5) West Island; (6) Chain Island; (7) Montezuma Island; (8) Seal Island; (9) Edith Point; and, (10) Barker Slough (see IV.I for details.)

IV.D. General Distribution

The distribution of *Lilaeopsis masonii* is mainly within the Sacramento-San Joaquin Delta and Suisun Bay. Three additional populations occur within the Napa River watershed, and several other populations occur in Suisun Marsh. Interestingly, there is a voucher specimen for *Lilaeopsis masonii* from Tomales Bay (Marin County), deposited at the U.C. Berkeley Herbarium, but an intensive survey of the recorded site did not locate the population. We believe that this population has probably become extirpated (see section V.I. for more information on this location). Counties that have recorded populations of *Lilaeopsis masonii* include Contra Costa, Napa, Sacramento,

San Joaquin and Solano.

IV.E. Habitat and Habit

Lilaeopsis masonii occupies the littoral zone in the fresh water and brackish tidal marshes of the Sacramento-San Joaquin Delta, Suisun Bay, Suisun Marsh, and the Napa River. As such, populations of *Lilaeopsis masonii* are inundated twice daily by high tides, but are also exposed much of the day by low tides. However, since the times of high and low tides vary daily, during some days *Lilaeopsis masonii* will spend a significant portion of the daylight period (when it would be photosynthetically active) underwater, while other times of the month just the opposite is true.

The habitat of *Lilaeopsis masonii* is typically a tidally inundated, wave-cut beach or earthen levee. Any given population is therefore transient because erosion is constantly causing the substrate to slump into the adjacent water body. But because *Lilaeopsis masonii* is so successful at spreading vegetatively by rhizomotous growth, it can tolerate these disturbances very well. Indeed, these natural episodes of erosion in its environment may be instrumental in protecting the low-growing populations of *Lilaeopsis masonii* from being overgrown and eventually replaced by larger plants that may require more stable substrate.

Lilaeopsis masonii is mostly found growing on clay with significant amounts of silt and organic matter (see IV.G), but occasionally occurs on old pilings or pure sand. As mentioned above, the plant probably reproduces primarily by vegetative lateral spread of its rhizomes; therefore, most populations are likely composed of clonal colonies (ramets) (Plate 2). No seedlings were seen at any of the sites investigated in this study. Small clonal tufts of *Lilaeopsis masonii* were observed floating in the Delta region. This may be a significant method by which sites are colonized.

Lilaeopsis masonii was recorded growing on sites inundated by saline waters as low as 0.25 parts

per thousand (ppt.),and as high as 8.5 ppt. Further field investigations of its distribution may show populations tolerating even higher salinities than presently recorded. Importantly, *Lilaeopsis masonii* is widespread in fresh water tidal habitats as well.

The largest and healthiest populations were found growing on the uninhabited islands in Suisun Bay where there is no rip-rap and little human activity. As might be expected, the smallest and most endangered populations occupy sites with extensive rip-rap or on old pilings and in locations with a lot of foot traffic (Plate 3).

IV.F. Plant Associates

Plant species that are most commonly associated with *Lilaeopsis masonii* in the littoral zone are *Scirpus californicus* (85.7%), *Hydrocotyle verticillata* var. *triradiata* (54.3%), and *Scirpus cernuus* var. *californicus* (48.6%) (Table 2, Plate 4). *Lilaeopsis masonii* is found most commonly growing amongst the older rhizomes of the *Scirpus californicus* (California bulrush) and amongst the newer rhizomes (Plate 5). Its herbaceous associates immediately in the littoral zone are *Hydrocotyle verticillata* var. *triradiata* (marsh pennywort) and *Scirpus cernuus* var. *californicus* (low club rush). All four species are indigenous to the Delta region, and their high frequency of occurrence reflects those areas of the littoral zone that are generally inaccessible. An additional 57 species occurred less than 20% of the time within the littoral zone (Appendix C).

Plant species most commonly found in the near shore regions behind the littoral zone supporting *Lilaeopsis masonii* are *Salix* spp. (40%), *Rubus procerus* (37.1%), *Polygonum persicaria* (31.4%), and *Scirpus californicus* (28.8%) (Table 3). *Salix* spp. are ubiquitous throughout the Delta and therefore are the most commonly found near shore associate. *Rubus procerus* (himalaya berry) has become naturalized in northern California, and its occurrence in the near shore reaches of the Delta is to be expected. *Polygonum persicaria* is naturalized from Europe, and appears to tolerate the disturbances (both natural and human) found in this region. Finally, the *Scirpus*

TABLE 2. Plant Species Commonly Found Associated with *Lilaeopsis masonii* In The Littoral Zone

Species	Frequency of Occurrence (%)
Scirpus californicus	85.7
Hydrocotyle verticillata var. *triradiata*	54.3
Scirpus cernuus var. *californicus*	48.6
Agrostis semiverticillata	31.4
Triglochin striata	28.6
Juncus oxymeris	25.7
Limosella subulata	25.7
Lythrum californicum	25.7
Polygonum persicaria	25.7
Helenium bigelovii	25.7

TABLE 3. Plant Species Commonly Found Associated with *Lilaeopsis masonii* In The Near Shore Zone

Species	Frequency of Occurrence (%)
Salix spp.	40.0
Rubus procerus	37.1
Polygonum persicaria	31.4
Scirpus californicus	28.8
Helenium bigelovii	25.7
Paspalum dilatatum	25.7
Lythrum californicum	25.7
Calystegia sepium	25.7
Aster chilensis var. *lentus*[3]	22.8

[3]This species should be verified. *Aster exilis* is also known commonly from the Delta; in many instances during this survey, the identity of this rare species was not verified.

californicus appears to dominate most of the vegetation within the tidal zone along the confluence of the Sacramento-San Joaquin River, and westward.

IV.G. Substrate

Populations of *Lilaeopsis masonii* were found most frequently on a clay substrate (57.0%), typically with a high organic matter content (34.5%; Plate 6). Equally less frequently, *Lilaeopsis masonii* was found growing on a predominantly silt substrate (17.1%; Plate 7) or on sand (17.1%; Plate 8). *Lilaeopsis masonii* appears to have established on silt and clay deposition within older rip-rap (14.3%) and on old abandoned pilings (11.4%; Plate 9). Given this broad tolerance of substrate texture, it is likely that substrate physical characteristics do not limit the distribution of this rare plant.

IV.H.Status of All Known Populations (Natural Diversity Data Base)

CNDDB-OCC# 01

Figure: 2; Plate 10

Date: 28 June 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Contra Costa

Directions: Antioch Dunes just east of the PG&E towers

Habitat Description: This is a very small population of a few dozen ramets occupying the frame of an old and rotting beached barge.

Water Salinity: 1.0 ppt.

Water Temperature: 24.5^0 C

Water pH: 6.0

Substrate: Silt on rotting pilings

Comments: This is a very small population of only a few ramets of *Lilaeopsis masonii*

inhabiting a few rotting pilings that are soon to be lost.

CNDDB-OCC# 02

Figure: 3

Date: 26 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Solano

Directions: East of Collinsville resort, between the resort and Marshall Cut along the Sacramento River.

Habitat Description: Small population (2m x 2m), of a few ramets growing between the rhizomes of *Scirpus californicus*.

Substrate: Sand

Water Salinity: 2.0 ppt.

Water Temperature: 29.0^{0} C

Water pH: 6.4

Comments: None

CNDDB-OCC# 03

Figure: 3

Date: 26 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Solano

Directions: Just east of the mouth of Marshall Cut; east of old Collinsville resort along the Sacramento River.

Habitat Description: Very dense populations of ramets, 1-3m wide along approximately

300 m of bank, growing on the bank with rip-rap between the population and the river.

Substrate: Silt with organic matter

Water Salinity: 2.0 ppt.

Water pH: 6.3

Water Temperature: 25.0^0 C

Comments: Individuals in flower. Very healthy populations with no apparent threats.

CNDDB-OCC# 04

Figure: 3

Date: 26 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Solano

Directions: West side of Marshall Cut approximately 0.5 miles east of Collinsville resort on the Sacramento River.

Habitat Description: Large healthy population along an 18m stretch of the substrate with a width of up to 5 meters. No rip-rap at this location.

Substrate: Silt with organic matter

Water Salinity: 2.0 ppt.

Water Temperature: 25.0^0 C

Water pH: 6.3

Comments: None

CNDDB-OCC# 05

Figure: 3; Plate 11

Date: 29 June 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Sacramento

Directions: All along the northwest to west side of Montezuma Island near Collinsville resort on the Sacramento River in Suisun Bay.

Habitat Description: Numerous populations along the banks of Montezuma Island. Contiguous populations ranging in size from 2 x 2m up to 3 x 1m each. This is a relatively isolated habitat with no apparent threats.

Substrate: Silt with organic matter

Water Salinity: 1.5 ppt.

Water Temperature: 25^0 C

Water pH: 6.3

Accessibility: Boat only

Comments: Very healthy populations with no obvious threats and no rip-rap.

CNDDB-OCC# 06

Figure: 4

Date: 12 July 1990

Observers: Golden and Pearson

Quad: Jersey Island

County: Solano

Directions: On a sandy and silty beach of the Sacramento River just northeast of Tolands Landing.

Habitat Description: Plants growing on a sandy substrate between the exposed roots of *Scirpus californicus* and *Phragmites communis* var. *berlandieri*. Two large contiguous populations of 6m^2 each and several smaller populations were observed along a 100m stretch of beach along the Sacramento River.

Substrate: Silt with significant organic matter and sand

Water Salinity: 0.0 ppt.

Water Temperature: 27.0^0 C

Water pH: 6.1

Comments: Populations look very healthy with no known threats

Accessibility: Boat or car

CNDDB-OCC# 07

Figure: None

Date: 14 July, 1955

Observers: Mathias & Constance (1977)

Quad: Jersey Island

County: Sacramento

Directions: According to Mathias and Constance,"Twitchell Island margin of Sacramento River 6.5 miles south of Rio Vista."

Habitat Description: " Mostly sandy soil w/ *Scirpus* and *Equisetum.*" Type locality. Mapped 6.5 mile due south of Rio Vista on Sherman Island.

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: The description of this occurrence location is unclear. The Sacramento River does not flow past Twitchell Island, however Three Mile Slough does. We did locate a very small (1.0m^2) population of *Lilaeopsis masonii* on silt amongst some rip-rap on a Sherman Island levee across from Twitchell Island adjacent to Three Mile Slough. Dr. Lincoln Constance was contacted in hopes of clarifying the discrepancies in the type locality description. Unfortunately, Dr. Constance said that he could not remember the exact location of the original populations. However, after describing the site on Three

Mile Slough to Dr. Constance, he said that it could very well be the original location.

Accessibility: Car or Boat

CNDDB-OCC# 08

Figure: 5; Plate 12

Date: 25 July 1990

Observers: Fiedler and Golden

Quad: Jersey Island

County: Sacramento

Directions: Just east of the Antioch bridge at the base of the old bridge foundation on the north bank of the San Joaquin River.

Habitat Description: This is a small population inhabiting silt about $0.5m^2$ in area bounded by rip-rap.

Substrate: Silt with significant organic matter content

Water Salinity: 0.25 ppt.

Water Temperature: 27.0^0 C

Water pH: 6.4

Comments: This extremely small population is bounded by riprap and therefore has no appropriate substrate in which to spread. Threats are from further riprapping and human activities such as fishing.

Accessibility: Car

CNDDB-OCC# 09

Figure: 5

Date: 25 July 1990

Observers: Fiedler and Golden

Quad: Jersey Island

County: Sacramento

Directions: 1/2 mile east of the Antioch Bridge on the north side of the San Joaquin River.

Habitat Description: There are three small populations of approximately 1m x 0.75m in area each amongst rip-rap where enough sediment has accumulated to support root growth.

Substrate: Silt

Water Salinity: 0.25 ppt.0.

Water Temperature: 27^0 C

Water pH: 6.4

Comments: These extremely small populations are bounded by riprap and therefore have little appropriate substrate in which to spread. Threats are from further riprapping and human activities such as fishing due to foot traffic and subsequent trampling.

Accessibility: Car

CNDDB-OCC# 10

Figure: 6; Plate 3

Date: 13 July 1990

Observers: Fiedler and Golden

Quad: Napa

County: Napa

Directions: On old pilings on the west bank of the Napa River 1/4 mile down river from the Imola bridge (end of a private road).

Habitat Description: There are three small populations each located on top of an old piling and one small population growing at the base of a fallen tree. The ramets range in size from 0.5m x 0.5m to 2m x 0.5m.

Substrate: Silt with significant organic matter content

Water Salinity: 10.5 ppt.

Water Temperature: 27.0^{0} C

Water pH: 5.7

Comments: These very small populations are threatened by human activity such as fishing and the eventual rotting away of the old pilings on which they grow. In addition, these populations may be distinct genotypes relative to the populations found on the Sacramento and San Joaquin Rivers as they are relatively isolated from the other populations. Therefore, these populations are extremely threatened because they are very small and because they inhabit old pilings that are actively rotting.

Accessibility: Car

CNDDB-OCC# 11

Figure: 7

Date: 5 May 1957

Observers: Mathias and Constance (1977) (from CNDDB files)

Quad: Fairfield South

County: Solano

Directions: According to the CNNDB directions, this occurrence is in Suisun Marsh approximately 1 mile south of the city of Suisun.

Habitat Description: According to the CNNDB, *Lilaeopsis masonii* is growing on wet soil at the edge of the slough with *Triglochin* sp. and *Juncus* sp. The size or condition of the populations is not known.

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: Population was not observed by Fiedler and Golden

Accessibility: Unknown

CNDDB-OCC# 12

Figure: None

Date: 17 August 1978

Observers: Willoughby and Palmer (from CNDDB files)

Quad: Antioch North

County: Sacramento

Directions: "Sherman Island, west side of main reclaimed island."

Habitat Description: "On muddy shores forming low turf with *Triglochin striata* and *Hydrocotyle verticillata var. triradiata.* Two separate colonies."

Substrate: Silt with significant organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This site was not observed by Fiedler and Golden. However, on 15 June, 1988, the California Department of Water Resources reported three locations of *Lilaeopsis masonii* near the general area described as CNDDB Occ #12. Threats are reported to be mainly from riprap. *Lilaeopsis masonii* was also reported to be in flower at the time of observance.

Accessibility: By car.

CNDDB-OCC# 13

Figure: 2; Plate 13

Date: 17 August 1978

Observers: Willoughby and Palmer (from CNDDB files); Fiedler and Golden

Quad: Antioch North

County: Sacramento

Directions: Donlon Island, west shores of the outermost islet to the west of island

Habitat Description: Associated with *Triglochin striata* and *Hydrocotyle verticillata* var. *triradiata.*

Substrate: Silt with significant organic matter content (?)

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This site was observed by Fiedler and Golden but was not investigated as it was determined to be unsafe due to high winds and a strong current during that day. The site appeared to have *Lilaeopsis masonii* present. The population appeared robust and relatively large.

Accessibility: Boat

CNDDB-OCC# 14

Figure: 2

Date: 22 July 1990

Observers: Willoughby and Palmer (1978) (from CNDDB files)

Quad: Antioch North

County: Sacramento

Directions: According to the CNDDB;Sherman Island just west of Donlon island. (1 mile north of the west end of West Island.)

Habitat Description: This site was not surveyed by Fiedler and Golden

Substrate: Silt with significant organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: None

Accessibility: Boat

CNDDB-OCC# 15

Figure: 3

Date: 16 August 1990

Observers: Golden and Zebell

Quad: Antioch North

County: Sacramento

Directions: All along the northwest to southwest side of Chain Island on the Sacramento River southwest of Collinsville.

Habitat Description: Many populations in the littoral zone on organic substrate. Most plants observed in flower.

Substrate: Clay with high organic matter content

Water Salinity: 1.5 ppt.

Water Temperature: 23.0^0 C

Water pH: 6.5

Comments: Chain Island is a relatively isolated island in the northern portion of Suisun Bay and the Sacramento River. These are large, healthy populations (1-2 m in width), inhabiting a long stretch of the island in the littoral zone. There are no apparent threats to these populations at this time.

Accessibility: Boat

CNDDB-OCC# 16 and 17

Figure: 3

Date: 17 August 1990

Observers: Golden and Zebell

Quad: Antioch North

County: Sacramento

Directions: All along the western most end of Sherman Island (west of Sherman Lake), between Kimball Island and Point Sacramento on Broad Slough.

Habitat Description: On banks of high organic content dominated by *Scirpus californicus* and *Trighlochin striata.* Many populations each approximately 0.5m x 3.0m in area spread intermittently along the banks of Sherman Island.

Substrate: Clay with high organic matter content

Water Salinity: 1.0 ppt.

Water Temperature: 23^0 C

Water pH: 6.1

Comments: Most plants in flower. Many healthy populations with no immediate threats.

Accessibility: Boat

CNDDB-OCC# 18

Figure: 7

Date: 13 July 1990

Observers: Fiedler and Golden

Quad: Fairfield South

County: Solano

Directions: Promontory at Hill Slough on the south side of Grizzly Island road near the Hill Slough bridge.

Habitat Description: One healthy population approximately 2.m x 1.0 m in area. Dominated by *Scirpus californicus* and *Hydrocotyle verticillata* var. *triradiata.*

Substrate: Silt with significant organic matter content

Water Salinity: 5.0 ppt.

Water Temperature: 29.0^0 C

Water pH: 6.1

Comments: This is an interesting habitat as there are only two other reported populations in the Suisun Slough area. This population is not known to be threatened at this time. Further investigation by boat in this area will probably locate new populations of *Lilaeopsis masonii*.

Accessibility: Car

CNDDB-OCC# 19

Figure: 2

Date: 28 July 1991

Observers: Fiedler and Golden

Quad: Antioch North

County: Contra Costa

Directions: Along the waterfront of the San Joaquin River in the PG&E picnic area (private).

Habitat Description: One small population (28.0 cm x 13.0 cm), growing in silt on riprap where enough sediment has accumulated between the rocks.

Substrate: Silt with significant organic matter content

Water Salinity: 0.5 ppt.

Water Temperature: 28.0^0 C

Water pH: 6.3

Comments: This population was accessed through a locked gate on PG&E property. The population is extremely small and is precariously clinging to a small portion of a relatively horizontal rock amongst the riprap where enough sediment has accumulated to support it. Threats include further riprapping as well as erosion from the river.

Accessibility: Car

CNDDB-OCC# 20

Figure: None

Date: 28 August 1981

Observers: C. Patterson, Plant Ecologist, Private Consultant (from CNDDB files)

Quad: Holt

County: San Joaquin

Directions: North side of the San Joaquin River at the confluence of Fourteen Mile Slough, between Morrison and Walters Islands.

Habitat Description: 0-20 ft. elevation on muddy banks, open and flat. Eleven - 50 plants in area less than $5m^2$. Associated with tules and *Salix* spp.

Substrate: Probably silt with high organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This occurrence was not observed by Fiedler and Golden. Patterson reports bank erosion along the Stockton Ship Channel to be a threat.

Accessibility: Unknown

CNDDB-OCC# 21

Figure: 8

Date: 18 August 1990

Observers: Golden and Fiedler

Quad: Antioch North

County: Contra Costa

Directions: Northwest end of Brown's Island in Suisun Bay.

Habitat Description: Many populations on this relatively inaccessible island are found with *Scirpus californicus*, *Triglochin striata*, and *Hydrocotyle verticillata* var. *triradiata*.

The largest population observed was approximately $20m^2$ in area.

Substrate: Clay with high organic matter content

Water Salinity: 2.5 ppt.

Water Temperature: 22.0^0 C

Water pH: Unknown

Comments: This is a difficult location on which to land by boat, due to the relatively shallow water, strong currents, and high waves. Because of this limited accessibility, the populations appear to be relatively free of any threats. Some of the largest and healthiest populations observed in this study occupy this island. As the conditions were not very favorable to investigate more of the island by boat, there is reason to believe that there may be many more large populations growing on much more of the island than has been reported. Also, it is not known if W. Knight who first reported this location actually landed on the island since *Triglochin* sp. is very common at this site and from a distance appears to look like *Lilaeopsis masonii*. Though this is one of the healthier habitats observed in this investigation, it is important to actually check each possible population to determine whether the species of interest is present.

Accessibility: Difficult; by boat only.

CNDDB-OCC# 22

Figure: 9

Date: 1978 and 1990

Observers: McCarten in 1990 and Mason 1978 (from CNDDB files)

Quad: Bouldin Island

County: Contra Costa

Directions: All along Frank's Tract (according to Mason on the CNDDB #22), as well as 7 other populations along the northern portion of Frank's Tract according to McCarten (McCarten 1990).

Habitat Description: Found on muddy or silty soil in the littoral zone with *Scirpus robustus* and between rocks of rip-rap areas (McCarten 1990).

Substrate: Mud and silt with significant organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: These populations were not investigated by Fiedler and Golden as the study by McCarten was in progress at the time of this investigation. See McCarten (1990), for a detailed account of the distribution of *Lilaeopsis masonii* at Frank's Tract.

Accessibility: Boat

CNDDB-OCC# 23

Figure: 10; Plates 2 & 14

Date: 26 July 1990

Observers: Fiedler and Golden

Quad: Rio Vista

County: Sacramento

Directions: Sandy beach approximately 1.5 miles south of the junction of highway 160 and highway 12 along the Sacramento River.

Habitat Description: Several populations distributed in small patches along a 20m portion of the beach parallel to the river. Several patches measured were as follows: 10.0m x 4.0m, 2.5m x 1.0m, 4.0m x 3.0m, 6.0m x 3.0m, and 2.0m x 2.0m. On sandy beach in the littoral zone dominated by *Scirpus californicus*.

Substrate: Sand and silt with significant organic matter content - patchily distributed

Water Salinity: 0.0 ppt.

Water Temperature: 25.0^0 C

Water pH: 6.5

Comments: This site is somewhat protected from strong wave action by old pilings that lay between the populations and the river. This is probably how the populations are able to occur on an otherwise transient substrate such as sand. However, there are many small rocks, old roots, and peat intermixed with the sand that probably helps to form this apparently relatively stable substrate. See also CNDDB Occ #38 and #39 for more information on this habitat.

Accessibility: Car

CNDDB-OCC# 24

Figure: 8

Date: 18 August 1990

Observers: Golden and Zebell

Quad: Antioch North

County: Contra Costa

Directions: On the southwest end of Winter Island in Suisun Bay

Habitat Description: Many small populations along the bank in the littoral zone ranging in size from 10.m^2 to 3.0m^2

Substrate: Silt with significant organic matter content

Water Salinity: 1.4 ppt.

Water Temperature: 22.0^0 C

Water pH: Unknown

Comments: No apparent threats at this time. In 1984, Tim Messick noted that the U.S. Army Corp of Engineers was planning to dump dredged sand across (not on) the levee of Winter Island. It is not known if this has since occurred, or if it has, what effect it may or may not have had on these populations.

Accessibility: Boat

CNDDB-OCC# 25

Figure: None

Date: 15 August 1984

Observers: California Department of Water Resources (DWR) 1984 (from CNDDB files)

Quad: Liberty Island

County: Solano

Directions: Cache Slough; Near the pump station west of Peter's Pocket, west-southwest of Liberty farms. (Barker Slough?).

Habitat Description: 15 clusters in splash zone along the east bank of Barker Slough.

Substrate: Probably peat

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This site was not investigated by Fiedler and Golden. The DWR investigator notes that dredging is a possible threat to this population.

Accessibility: Unknown

CNDDB-OCC# 26

Figure: 11

Date: 11 June 1985

Observers: Virginia Dains, private consultant, Auburn, CA (from CNDDB files)

Quad: Rio Vista

County: Sacramento

Directions: 0.5 miles east of the confluence of Steamboat Slough and the Sacramento River on the north bank of Grand Island.

Habitat Description: In tidally inundated fresh water marsh bordering the slough on sod formed by *Verbena hastata*. Associated with *Alnus rhombifolia* and *Salix* spp.

Approximately 100 plants seen in 1985.

Substrate: Silt with significant organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: We were unable to locate this site. The tides were very low the day we investigated and we were able to walk along a two mile stretch of the beach on the north end of Grand Island near the confluence of Steamboat Slough and the Sacramento River. We found no populations of *Lilaeopsis masonii* nor did we find a freshwater marsh bordering the slough at this location. Our conclusion is that the site is poorly described and may be at another location.

Accessibility: Unknown

CNDDB-OCC# 27

Figure: 12

Date: 20 August 1990

Observers: Golden and Zebell

Quad: Rio Vista

County: Solano

Directions: On a tule island at the confluence of Miner Slough and the Sacramento Deep River Channel.

Habitat Description: Many populations on the many small and larger tule islands. Very healthy looking populations all in flower. Some islands appear to be relatively pristine.

Substrate: Peat

Water Salinity: 0.0 ppt.

Water Temperature: 24.0^0 C

Water pH: 6.0

Comments: These are beautiful up-river sites on relatively pristine patches of riparian woodlands including *Alnus rhombifolia*, *Cornus stolonifera*, and *Quercus* spp. *Lilaeopsis masonii* inhabits the littoral zone of these sites with *Scirpus californicus* and *Hydrocotyle verticillata* var. *triradiata*. *Limosella subulata* was also observed in flower.

Accessibility: Boat

CNDDB-OCC# 28

Figure: 13

Date: 06 August 1986

Observers: Joyce Lacey (from CNDDB files)

Quad: Fairfield South

County: Solano

Directions: "Southwest part of Joice Island, approximately 1/4 mile north of the hunting club house on Suisun Slough."

Habitat Description: "50 individuals seen in 1986 at shoreline. At base of *Scirpus* stand on Reyes silty clay."

Substrate: Reyes silty clay

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This site was not investigated by Fiedler and Golden as hunting season was open at the time of reconnaissance. Also, the site description is very general, though it would probably be fruitful to explore much of the general area as it may support many as yet undiscovered populations of *Lilaeopsis masonii*. Lacey observed active erosion at the site but did not otherwise recognize any visible threats to the population.

Accessibility: Unknown

CNDDB-OCC# 29

Figure: 14

Date: 8 August 1986

Observers: Virginia Dains, Private consultant, Auburn, CA (from CNDDB files)

Quad: Woodward Island

County: San Joaquin

Directions: "On Old River on the south end of the tule island immediately north of Fay Island."

Habitat Description: 50-100 individuals seen in 1986 in small patch with *Hydrocotyle*, *Crassula aquatica* and *Juncus effusus* [var. *pacificus*?]."

Substrate: Probably silt with organic matter

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This population was searched for by Golden and Fancher, but was not discovered. The site of Dain's description was located, but it is not known if the population is extinct or if the population was just under water at the time the site was investigated. In essence, we were at the reported location at low tide, but this was on 17 January 1991 when the low tide was at 2.8 feet, a relatively high-low tide. Nevertheless, Dains reported possible threats to the population as being from bank erosion since, "the channel is a popular waterski area. Many similar habitats are dominated by *Crassula* with no *Lilaeopsis masonii* present." There should be another attempt to locate this population when the tides are more favorable.

Accessibility: Boat

CNDDB-OCC# 30

Figure: 15

Date: 8 August 1986

Observers: V. Dains, Private consultant, Auburn, CA (from CNDDB files)

Quad: Woodward Island

County: San Joaquin

Directions:" On tidal flat in Middle River at the mouth of Empire Cut."

Habitat Description: According to V. Dains, " Approximately 1000 plants seen in 1986 on a 10 ft^2 chunk of clay exposed at low tide with *Crassula aquatica* and *Limosella subulata*. Good site quality - nearly pure stand. According to W. Knight, this population is equal to or better than the Brown's Island populations." As explained above for CNDDB Occ #29, Golden and Fancher were unable to locate this population. Again, it may be because the low tide was not favorable, or it could be due to population extinction.

Substrate: Probably peat.

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: It is recommended that further investigation be done in order to determine whether or not this population is extinct or still intact. It should be noted, however, that Dains felt that erosion was a threat to this population.

Accessibility: Boat

CNDDB-OCC# 31

Figure: 8; Plate 15

Date: 25 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Contra Costa

Directions: Between Pittsburgh and Antioch, just west and just east of where the Contra

Costa Canal spillway meets New York Slough.

Habitat Description: West side of the canal: Several small populations (approximately 1.0m x 1.0m in area each), extending approximately 75m along the shoreline in a patchy distribution. These populations extend up to but do not exist on the rip-rap. East side: There are several small populations growing on old pilings and on some rip-rap where enough sediment has accumulated to support *Lilaeopsis masonii*.

Substrate: Silt with organic matter and sand.

Water Salinity: 3.0 ppt.

Water Temperature: 24.0^0 C

Water pH: 5.8 on the west side and 6.5 on the east side

Comments: The west side populations look healthy with the main threats being from trampling by humans and riprapping. This would be an excellent location for a local park. The east side population are small and are barely surviving on old rotting pilings and rip-rap. Threats to these plants are also from trampling and riprap, but also from river erosion as the sediments on the riprap that support these populations are not well attached to the rocks. In addition, as many of the individuals are located on rotting pilings they are extremely threatened since these pilings and thus much of the habitat will eventually be lost.

Accessibility: Car

CNDDB-OCC# 32

Figure: 8

Date: 25 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Contra Costa

Directions: West of Antioch Point, northwest of Antioch, at the confluence of New York Slough and the San Joaquin River.

Habitat Description: This small population is approximately 1.0m^2 in area. It is growing above the riprap.

Substrate: Clay with high organic matter content

Water Salinity: 1.5 ppt.

Water Temperature: 24.0^0 C

Water pH: 6.2

Comments: The riprap at this site looks relatively new and may have extirpated some of the populations, as four subpopulations were reportedly seen in 1985. We only located one population. Also, there is a small island nearby that may harbor more populations of *Lilaeopsis masonii*. We recommend that this island be surveyed. This locations appears to be threatened by more riprapping and by trampling by fisherpersons.

Accessibility: Car

CNDDB-OCC# 33

Figure: 2

Date: 30 June 1987

Observers: Bailey, W.

Quad: Antioch North

County: Sacramento

Directions: West of Donlon Island, north of West Island at the south junction of Mayberry Cut and the San Joaquin River.

Habitat Description: Two small populations observed, approximately 0.5m x1m and the other 1.0m x 2.0m in size. Some flowers were observed.

Substrate: Peat

Water Salinity: 1.0 ppt.

Water Temperature: 22.0^{0}C

Water pH: 5.7

Comments: We did not investigate this particular occurrence, although we have thoroughly surveyed the immediate area. According to Bailey, water hyacinth herbicide control program (2,4 D), is a threat as hyacinth (*Eichornia crassipes*) also was taking over some of the habitat. Although we have observed water hyacinth to be a problem upriver on the San Joaquin River, it was not been seen by us in this area. This appears to be small but healthy populations with no apparent threats.

Accessibility: Boat

CNDDB-OCC# 34

Figure: None

Date: 27 July 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Sacramento

Directions: The south end of Donlon Island on the San Joaquin River.

Habitat Description: Small population on clay with significant organic matter

Substrate: Clay with high organic matter

Water Salinity: 0.25 ppt.

Water Temperature: 24.5^0 C

Water pH: 6.2

Comments: No known threats to this population at this time

Accessibility: Boat

CNDDB-OCC# 35

Figure: 16; Plate 16

Date: 13 July 1990

Observers: Fiedler and Golden

Quad: Cuttings Wharf

County: Napa

Directions: West end of Suscol creek: at the confluence with the Napa River on the east bank under the bridge. West end of Suscol Road.

Habitat Description: Three small, fragmented populations with areas of 2.0m x 0.3m, 2.0m x 0.3m, and 1.0m x 2cm respectively.

Substrate: Silt/mud

Water Salinity: We measured salinity to be >40.0 ppt. This likely is an artifact of the polluted waters at this location, but a repeat measurement is necessary to confirm the reading.

Water Temperature: 28.0^0 C

Water pH: 5.6

Comments: This is a poor quality site where much recreational fishing, off-road vehicular use, and homeless people all threaten the habitat. This is one of the few sites where *Salicornia virginiana* and *Atriplex patula var. hasta* were associated with *Lilaeopsis masonii* in the littoral zone, indicating a relatively high saline environment. There are few known Napa River populations and these should be protected to preserve as much of the gene pool as possible. These plants may be relatively adapted to more brackish conditions than are the populations found farther up the Sacramento and San Joaquin Rivers.

Accessibility: Car

CNDDB-OCC# 36

Figure: 6; Plate 17

Date: 13 July 1990

Observers: Fiedler and Golden

Quad: Napa

County: Napa

Directions: 100 yards south of the Third Street bridge over the Napa River on the west bank in the city of Napa.

Habitat Description: *Lilaeopsis masonii* was found growing on seven rotting pilings, each approximately $0.3m^2$ and also on three sites on rip-rap covering less than $1.0m^2$.

Substrate: Silt/mud

Water Salinity: 8.5 ppt.

Water Temperature: 28.0^0 C

Water pH: 5.7

Comments: These very small and threatened populations are probably the remnants of a historically much larger range of *Lilaeopsis masonii*. These may very well compose a different genotype than those populations of the Sacramento and San Joaquin Rivers as they are relatively isolated from the existing main population. Populations at this site are extremely threatened as they exist mostly on rotting pilings. The three small populations found on the riprap are exposed to trampling by recreational users of the area, as well as more riprap. Protection of these populations might include, perhaps, but should not be limited to, *ex situ* propagation. Transplants of small portions of these populations to nearby areas may help protect the genotype here. Modification of this site is also recommended, including additional acquisition or creation of more habitat at this location and also possibly restricting access. A study to determine the feasibility of habitat creation in this area is recommended.

Accessibility: Car

CNDDB-OCC# 37

Figure: 17

Date: 28 July 1990

Observers: Fiedler and Golden

Quad: Jersey Island

County: Sacramento

Directions: Brannan Island State Recreation Area on the east side of the island near the swimming area.

Habitat Description: The populations extend along the shore for approximately 30m with a width of 1.0m to 3.0 meters on silt and peat.

Substrate: Silt with some organic matter content

Water Salinity: 0.5 ppt.

Water Temperature: 29.0^0 C

Water pH: 7.7

Comments: Populations are relatively healthy especially in light of the fact that they occur near a recreation beach. For further information see McCarten (1989), who did a sensitive plant survey for the Department of Parks and Recreation on Brannan Island in 1989.

Accessibility: Car

CNDDB-OCC# 38

Figure: 17

Date: 28 July 1990

Observers: Fiedler and Golden

Quad: Jersey Island

County: Sacramento

Directions: Brannan Island State Recreation Area along the west shore of the Sacramento River.

Habitat Description: Very lush populations extending along a 1km stretch of the Sacramento River. See also McCarten (1990) for more information on these populations.

Substrate: Sand and silt.

Water Salinity: 2.0 ppt.

Water Temperature: 26.0^0 C

Water pH: 6.4

Comments: The populations that occupy this portion of Brannan Island probably extend down to CNDDB Occ #23. There are probably many more populations of *Lilaeopsis masonii* along this stretch of the Sacramento River between the Rio Vista bridge south to Three Mile Slough. See McCarten (1990) and the descriptions of CNDDB #23 and #39 for more information.

Accessibility: Car

CNDDB-OCC# 39

Figure: 10

Date: 8 August 1990

Observers: Fiedler and Golden

Quad: Rio Vista

County: Sacramento

Directions: Along highway 160 approximately 1 mile south of the Rio Vista bridge on the east side of the Sacramento River (just south of the RV park).

Habitat Description: This location has several dense populations extending over 80 m along the beach between old pilings and the levee. The populations end where riprap begins, at the southern and northern ends of the beach. Some of the individuals are very large and robust, with the leaf septations quite obvious. Most of the populations of *Lilaeopsis masonii* were in flower.

Substrate: Sand and clay with high organic matter content

Water Salinity: 0.0 ppt.

Water Temperature: 27.0^0 C

Water pH: 6.1

Comments: Like the populations at CNDDB #23 and #38, these populations are somewhat protected from strong wave action by old pilings that lay between the populations and the river. This is possibly how the populations are able to occur on an otherwise transient substrate such as sand. However, there are many small rocks, old roots, and peat intermixed with the sand that probably helps to form an apparently relatively stable substrate. This is also a popular beach for swimming and fishing, though the populations of *Lilaeopsis masonii* do not seem to be threatened by this activity since most appeared healthy and many individuals within the ramets are quite robust.

Accessibility: Car

IV.I. Status of New Locations

NEW-OCC A

Figure: 18

Date: 22 June 1990

Observers: Fiedler and Golden

Quad: Honker Bay

County: Contra Costa

Directions: On the east side of Harris Harbor approximately 1/2 way between the harbor launch site and Suisun Bay.

Habitat Description: In the littoral zone of a cow pasture. Heavily grazed area on organic substrate associated with *Distichlis spikata*, *Triglochin striata*, *Juncus bufonius*, and *Atriplex patula* var. *hastata*.

Substrate: Clay with high organic matter content

Salinity: 4.5 ppt.

Water Temperature: 23.0^0 C

Water pH: 5.9

Comments: This is a heavily grazed and trampled site. It is not known how extensive the population is as it was located during a rising tide.

Accessibility: Boat

NEW-OCC B

Figure: 2

Date: 27 June 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Sacramento

Directions: West end of West Island on the San Joaquin River

Habitat Description: Growing on clay/organic substrate in the littoral zone with *Scirpus californicus*, *Aster chilensis* var. *lentus*, *Rosa californica*, *Phragmites communis* var. *berlandieri*, *Cephalanthus occidentalis*, and *Paspalum dilatatum*.

Substrate: Clay with high organic matter content

Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: West Island, along with most of the other islands nearby in Suisun Bay, is a reactively wild environment and should be preserved because it supports many large and healthy populations of *Lilaeopsis masonii*.

Accessibility: Boat

NEW-OCC C

Figure: 2

Date: 17 August 1990

Observers: Golden and Zebell

Quad: Antioch North

County: Sacramento

Directions: On the north bank of Donlon Island approximately 120 meters from the power line in Mayberry Slough.

Habitat Description: Many populations growing along the north east part of the old levee within the littoral zone on organic substrate with *Scirpus americana, S. cernuus* var. *californicus, Hydrocotyle verticillata* var. *triradiata, Triglochin maritima, Salix* spp., *Rubus* spp., and *Alnus rhombifolia.*

Substrate: Clay with high organic matter content

Water Salinity: 1 ppt.

Water Temperature: 23.0^0 C

Water pH: 6.4

Comments: There are probably several more populations of *Lilaeopsis masonii* growing along the old levee at this site as the appropriate habitat is extensive. Other populations have been recently discovered in the general vicinity. There are no immediate threats to the populations.

Accessibility: Boat

NEW-OCC D

Figure: 12

Date: 9 August 1990

Observers: Golden

Quad: Rio Vista

County: Solano

Directions: On Ryer Island approximately 4 miles north of the Ryer Island ferry on Ryer

road (Highway 84). On Miner Slough at the confluence of Miner Slough and the Sacramento Deep River Channel.

Habitat Description: Growing on silt/organic substrate between the exposed roots of *Alnus rhombifolia*. Associated with *Lilaeopsis masonii* in this riparian habitat are *Hydrocotyle verticillata* var. *triradiata, Juncus balticus, Verbena bonariensis*, and *Cornus stolonifera* var. *californica.*

Substrate: Silt with organic matter content

Water Salinity: Unknown

Water Temperature: 28.0^0 C

Water pH: 6.0

Comments: This site is a beautiful riparian woodland that is a remnant of what was once a much larger habitat in the area. *Lilaeopsis masonii* appears healthy here. This site and the other adjoining riparian habitat should be protected since there is very little of this type of habitat left in the Delta.

Accessibility: Boat or car

NEW-OCC E

Figure: 3

Date: 29 June 1990

Observers: Fiedler and Golden

Quad: Antioch North

County: Sacramento

Directions: On Montezuma Island in Suisun Bay all along the south western margin of the island from the northwest corner to the southwest corner. These populations are an extension of CNDDB #5.

Habitat Description: This is a relatively isolated island in Suisun Bay with no apparent

threats to the habitat at this time.

Substrate: Clay with a high organic matter content

Water Salinity: 1.5 ppt.

Water Temperature: 25.0^0 C

Water pH: 6.3

Comments: This uninhabited island along with several others in Suisun Bay provide quality habitat with little human disturbances threatening. To best protect *Lilaeopsis masonii*, these islands should be preserved as they are.

Accessibility: Boat

NEW-OCC F

Figure: 19

Date: 20 October 1990

Observers: Golden and Peña

Quad: Bouldin Island

County: San Joaquin

Directions: Inner part of the south side of the tidal flat at Venice Cut between the Stockton Deep River Channel and the Middle River of the San Joaquin River (the inner part of Three River Reach).

Habitat Description: One population composed of three patches approximately 0.3m x 0.3m, 0.3mx 0.7m, and 1.0m x 1.0m respectively on peat. With *Scirpus californicus, Crassula aquatica, Juncus balticus, Rubus procerus*, and *Paspalum distichum.*

Substrate: Peat

Water Salinity: 0.0 ppt.

Water Temperature: 19.0^0 C

Water pH: 6.9

Comments: This population is the only one found in the area. In 1986 the Department of Army Corp of Engineers created a dredge material island (DMI), a few 100 meters to the north west of this population inside the old U-shaped levee. The Corps did not seed this island and has allowed it to be colonized by plants and animals by natural processes (England *et al.* 1990). Although there is a reservoir population of *Lilaeopsis masonii* close by the DMI, it has not been colonized by *Lilaeopsis masonii*. This may be due to the fact that the river current and the wind-generated fetch come from the direction of the Stockton Deep River Channel toward the *Lilaeopsis masonii* population. The DMI is between the Deep River Channel and the *Lilaeopsis masonii* population, making it nearly impossible for *Lilaeopsis masonii* seed or floating clumps to reach it. Also, the DMI is mostly composed of sand and is still settling. In fact, ripples in the sand within the tidal zone were observed by us indicating that the substrate is transient. This would make it difficult for *Lilaeopsis masonii* to establish there, particularly with its relatively shallow root system. Nevertheless, this newly created DMI has been colonized by over 100 native plants and may be one of the best ways in which to create new habitat in the Delta. Also, at least one DMI on Donlon Island was found to have a new population of *Lilaeopsis masonii*. See new OCC G for more information.

Accessibility: Boat

NEW-OCC G

Figure: 2 & 20

Date: 20 January 1991

Observers: Golden and Galo

Quad: Antioch North

County: Sacramento

Directions: On DMI grid #6 on Donlon Island.

Habitat Description: Many small individuals were found underneath the litter on a sandy-silty substrate. The population was found in association with *Crassula aquatica*, *Scirpus californicus, Alnus rhombifolia*, and many other annual herbs not in flower.

Substrate: Silty sand

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This must be a relatively new population since this DMI was created in 1984 (England *et al.* 1990). The plants may have formed from seedlings but this needs to be confirmed. There were many other annual seedlings just coming up throughout this area. It is not known if these islands are still settling. If they are, then this habitat may be only temporary and therefore so would these new populations of *Lilaeopsis masonii*. Nevertheless, it is an important discovery since we have a maximum age for these populations and their establishment. It is not surprising to find *Lilaeopsis masonii* colonizing this DMI because the largest and healthiest populations of *Lilaeopsis masonii* are all near by on the islands in the area in Suisun Bay and the San Joaquin River. These DMI's should be monitored as they provide a unique opportunity to determine the success rate of *Lilaeopsis masonii* colonization and long term establishment.

Accessibility: Boat

NEW-OCC H

Figure: 21

Date: 27 April 1988

Observers: Showers and Pourroy (from CNDDB files)

Quad: Vine Hill

County: Contra Costa

Directions: From just west of Edith Point to a site some distance to the east of the point (100 yards) in Suisun Bay.

Habitat Description: According to Showers, *Lilaeopsis masonii* " was observed growing in a continuous band from just west of Edith Point to a site some distance to the east of the point (100 yd). A portion of the population (20%) on the west side of the point was covered with oil, while most of the plants to the east escaped its direct effects."

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This is a population not listed in the CNDDB. It warrants further monitoring since it was impacted by the Shell Oil Refinery spill of 1988. It is not known at this time if the populations were able to survive the damage from being covered by the oil.

Accessibility: Boat

NEW-OCC I

Figure: 21

Date: 27 April 1988

Observers: Showers and Pourroy (from CNDDB files)

Quad: Vine Hill

County: Contra Costa

Directions: "Approximately 1/2 mile east of Point Edith in Suisun Bay."

Habitat Description: Not described

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: "Though this site is very close to the population that was oiled [New OCC H], it was found to be oil-free."

Accessibility: Boat

NEW-OCC J

Figure: 21

Date: 27 April 1988

Observers: Showers and Pourroy (from CNDDB files)

Quad: Vine Hill

County: Contra Costa

Directions: "Approximately 3/4 of a mile east of Point Edith at Hasting Slough and Suisun Bay".

Habitat Description: "On Peat"

Substrate: Peat

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: This is another new population discovered by D. Showers during the 1988 Shell Oil Survey, and was found to be oil-free.

Accessibility: Boat

NEW-OCC K

Figure: 21

Date: 27 April 1988

Observers: Showers and Pourroy (from CNDDB files)

Quad: Vine Hill

County: Contra Costa

Directions: On the west end of Seal Island in Suisun Bay

Habitat Description: In the littoral zone.

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: Approximately 30% of this population was discovered to be covered with oil. These are important populations, as they are the most "down-river" populations known in Suisun Bay. They may very well be more salt tolerant than populations farther up-river. It is strongly recommended that a long term monitoring program of at least five years be instituted to determine the effects the Shell Oil Spill has had on oiled populations of *Lilaeopsis masonii*. In addition, oil effects on *Lilaeopsis masonii* should be investigated in a laboratory to best determine oil toxicity levels.

Accessibility: Boat

NEW-OCC L

Figure: None

Date: 25 October 1988

Observers: de Becker (from CNDDB files)

Quad: Antioch North

County: Sacramento

Directions: " On banks, western edge of dike that forms perimeter of Donlon Island, and along eastern edge of island in Mayberry Cut."

Habitat Description: "On wet, clayey banks with overhanging *Rubus* . . ."

Substrate: Silt with organic matter content

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: The map provided by the PG&E botanist is not clear enough to pin-point the populations, but the area is known to have many populations of *Lilaeopsis masonii*.

Accessibility: Boat

NEW-OCC M

Figure: None

Date: 25 October 1988

Observers: de Becker (from CNDDB files)

Quad: Antioch North

County: Sacramento

Directions: "On 4 abandoned pilings under the Vaca-Dixon Contra Costa transmission line, on the south side of West Island, in the San Joaquin River."

Habitat Description: "Saturated substrate. Unknown whether it is regularly inundated."

Substrate: Silt with organic matter.

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: None

Accessibility: Boat

NEW-OCC N

Figure: None

Date: 28 September 1988

Observers: Kelch (from CNDDB files)

Quad: Antioch North

County: Contra Costa

Directions: "In northeast corner of central Antioch along small inlet immediately below RR trestle."

Habitat Description: "In tidal marsh growing at edge of water on bank and on logs that are tidally submerged daily. With *Hydrocotyle* sp., *Bidens laevis, Triglochin striata*, and *Scirpus* spp."

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: None

Accessibility: Car

NEW-OCC O

Figure: None

Date: 2 June 1989

Observers: Cuneo and Kelly (from CNDDB files)

Quad: Fairfield South

County: Solano

Directions: "Approximately 1000 feet south of fishing pier at the Peytonia Slough Ecological Preserve, Suisun City, Solano County. Located low mud bank at slough edge below an overstory of *Scirpus californicus* and *Scirpus americanus*. There is a tree (*Prunus*), directly south of location."

Habitat Description: "Coastal brackish marsh, tidal but fairly close to freshwater sources."

Substrate: "Mud"

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: "The two sections of mud bank on which these plants grow are to the north and south sides on an inlet which is used by fishermen. Protection may be necessary. In some areas south of the inlet plants form solid mat at elevations near 0.0 NGVD."

Accessibility: Car

NEW-OCC P

Figure: 16

Date: 15 July 1988

Observers: J. Callizo (from CNDDB files)

Quad: Cuttings Wharf

County: Napa

Directions: "Along the Napa River south of Napa, under the 'Southern Crossing' bridge." Antioch bridge and across from Donlon Island.

Habitat Description: "Intertidal riverbank, Intertidal riparian."

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: None

Accessibility: car

NEW-OCC Q

Figure: None

Date: 15 June 1988

Observers: California Department of Water Resources (from CNDDB files)

Quad: Antioch North

County: Sacramento

Directions: "On Mayberry Slough, approximately 1.10 miles west of Antioch Bridge and across from Donlon Island, on Sherman Island."

Habitat Description: "Plants found on clumps of moist soil at extreme edge of water."

Substrate: Peat

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: "Rip-rapping is a threat. Plants not found in these areas."

Accessibility: Car

NEW-OCC R

Figure: None

Date: 15 June 1988

Observers: California Department of Water Resources (DWR) (from CNDDB files)

Quad: Jersey Island

County: Sacramento

Directions: On Sherman Island from west side of Gallagher Slough up to the east side of Gallagher Slough on the San Joaquin River.

Habitat Description: "Plants found on moist soil at waters' edge."

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: "Rip-rapping is a threat. Plants are not found in these areas."

Accessibility: Car

NEW-OCC S

Figure: None

Date: 16 June 1988

Observers: California Department of Water Resources (DWR) (from CNDDB files)

Quad: Jersey Island

County: Sacramento

Directions: "On Sherman Island approximately 30 feet east of the River road bridge at western mouth of Threemile Slough."

Habitat Description: "Found on mud built-up rocks and log."

Substrate: Mud

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: None

Accessibility: Car

NEW-OCC T

Figure: None

Date: 16 June 1988

Observers: California Department of Water Resources (DWR) (from CNDDB files)

Quad: Jersey Island

County: Sacramento

Directions: "On Sherman Island approximately 0.6 miles south of the southern mouth of Three Mile Slough."

Habitat Description: None noted, but probably dominated by *Scirpus californicus* and rip-rap.

Substrate: Unknown

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: According to DWR, this location is threatened by riprapping.

Accessibility: Car

NEW-OCC U

Figure: 4

Date: 23 June 1988

Observers: C. Martz, California Department of Transportation, Sacramento.

Quad: Jersey Island

County: Sacramento

Directions: "South bank of Horseshoe Bend on Sherman Island. Growing in scattered colonies between Emmaton and Emma."

Habitat Description: "Plants growing at waters' edge in valley freshwater marsh community. Locally abundant on stabilized substrate (silts,clays) tending to be absent on more mobile sands."

Substrate: "Silts, clays"

Water Salinity: Unknown

Water Temperature: Unknown

Water pH: Unknown

Comments: "Most areas have been previously rocked in the past. There is only a narrow band of suitable habitat between levee slope and *Scirpus* offshore. Possible rock slope protection associated with Hwy 160 improvement may affect around 200 linear feet of shoreline."

Accessibility: Car

V. DISCUSSION OF FINDINGS

V.A. Summary of Environmental Data

As discussed above, *Lilaeopsis masonii* appears most frequently within the littoral zone of the Sacramento-San Joaquin Delta and elsewhere on a fine-grained substrate that has a high organic matter content. Water salinities and conductivities at low tide vary considerable, however. A summary of these results can be found in Table 4.

V.B. Populations Determined to be at Immediate Risk

Accessibility Threats

Many of the populations at risk are sites accessible by car. Locations that are easily accessible by car in the Delta and Napa River areas are likely to have extensive rip-rap and foot traffic. Seventeen (17) of the 39 populations (43%) listed in the CNDDB are accessible by car. However, this may skew the true percentage of the total occurrences that are actually threatened, because most occurrences accessible by car tend to be small populations or populations growing on old pilings or rip-rap. Most of the occurrences that have been discovered since 1988 (13 out of 20 or 65%) have required access by boat. Therefore, those areas of the Delta, Suisun Bay, Suisun Slough, and the Napa River

Table 4. Summary of Environmental Data

Occurrance	Salinity	Temperature	pH[1]	Substrate
1	1 ppt.	24.5°C	6.0	Rotting pilings
2	2 ppt.	29.0°C	6.0	Sand
3	2 ppt.	25.0°C	6.3	Clay with high OM content
4	2 ppt.	25.0°C	6.3	Clay with high OM content
5	1.5 ppt.	25.0°C	6.3	Clay with high OM content
6	0 ppt.	27.0°C	6.1	Silt and sand
7	UKN	UKN	UKN	UKN[2]
8	0.25 ppt.	27.0°C	6.4	Silt
9	0.025 ppt.	27.0°C	6.4	Silt
10	2 ppt.	27.0°C	5.7	Silt
11	UKN	UKN	UKN	UKN
12	2 ppt.	UKN	UKN	Silt with high OM content
13	UKN	UKN	UKN	Silt with high OM content (?)
14	UKN	UKN	UKN	Silt with high OM content (?)
15	1.5 ppt.	23.0°C	6.5	Clay with high OM content
16	1 ppt.	23.0°C	6.1	Clay with high OM content
17	1 ppt.	23.0°C	6.1	Clay with high OM content
18	5 ppt.	29.0°C	6.1	Silt with high OM content
19	0.5 ppt.	28.0°C	6.3	Silt with high OM content
20	UKN	UKN	UKN	Silt with high OM content (?)
21	2.5 ppt.	22.0°C	UKN	Clay with high OM content
22	UKN	UKN	UKN	Silt with high OM content
23	0 ppt.	25.0°C	6.5	Sand
24	1.4 ppt.	22.0°C	6.3	Silt with high OM content
25	UKN	UKN	UKN	UKN
26	UKN	UKN	UKN	UKN
27	0 ppt.	24.0°C	6.0	Peat
28	UKN	UKN	UKN	Reyes silty clay
29	UKN	UKN	UKN	Silt with high OM content (?)
30	UKN	UKN	UKN	Peat (?)
31	3 ppt.	24.0°C	5.8; 6.5	Silt with some OM and sand
32	1.5 ppt.	24.0°C	6.2	Clay with high OM content
33	1 ppt.	22.0°C	5.7	Peat
34	0.25ppt.	24.5°C	6.2	Clay with high OM content
35	>40 ppt. (?)	28.0°C	5.6	Silt/mud
36	8.5 ppt.	28.0°C	5.7	Silt/mud
37	0.5 ppt.	29.0°C	7.7	Silt with high OM content
38	2 ppt.	26.0°C	6.4	Silt and sand
39	0 ppt.	27.0°C	6.1	Clay with high OM content
A	4.5 ppt.	23.0°C	5.9	Clay with high OM content

[1]Salinity, conductivity, and pH were measured in the water body adjacent to the occurrence at low tide.

[2]UNK = unknown. This occurred when we did not survey the site, could not survey the site due to treacherous conditions, and/or the reports from which we gathered the data did not have this information.

Table 4. Summary of Environmental Data (cont.)

Occurrance	Salinity	Temperature	pH[3]	Substrate
B	UKN	UKN	UKN	Clay with high OM content
C	1 ppt.	23.0°C	6.4	Clay with high OM content
D	UKN	28.0°C	6.0	Peat
E	1.5 ppt.	25.0°C	6.3	Clay with high OM content
F	0 ppt.	190°C	6.9	Peat
G	UKN	UKN	UKN	Silt and sand
H	UKN	UKN	UKN	UKN
I	UKN	UKN	UKN	UKN
J	UKN	UKN	UKN	Peat
K	UKN	UKN	UKN	UKN
L	UKN	UKN	UKN	UKN
M	UKN	UKN	UKN	Peat
N	UKN	UKN	UKN	UKN
O	UKN	UKN	UKN	"Mud"
P	UKN	UKN	UKN	UKN
Q	UKN	UKN	UKN	Peat
R	UKN	UKN	UKN	UKN
S	UKN	UKN	UKN	"Mud"
T	UKN	UKN	UKN	UKN
U	UKN	UKN	UKN	"Silts, clays"

[3]Salinity, conductivity, and pH were measured in the water body adjacent to the occurrence at low tide.

requiring boats to survey provide the potential for many undocumented occurrences of *Lilaeopsis masonii*.

Chicken Ranch Beach, Marin County

The only documented occcurrence in Marin county is at Chicken Ranch Beach, a location discovered from an investigation of herbarium specimens at the UC Berkeley Jepson Herbarium. However, this occurrence was not located after a thorough survey of the area. We talked with two members of the local chapter of the California Native Plant Society who have botanized the area for many years and neither one had ever found *Lilaeopsis masonii*.

Chicken Ranch Beach is on Tomales Bay and is a high saline environment. *Salicornia* spp. and *Distichlis spicata* were observed at the site, confirming a saline environment. It is not known whether the extirpated population of *Lilaeopsis masonii* was adapted to this high saline environment, or if, in 1937 when it was first collected, it was growing near what may have been a perennial stream that flows into Tomales Bay at the beach. We were told that the stream is no longer perennial since development has taken place in the past few years, but that it may have been historically perennial. An historical investigation of the development history, including sewage and drainage modifications near this beach, may shed some light on the disappearance of *l. masonii*. There are no other records known to us of any populations of *Lilaeopsis masonii* from this area.

1988 Shell Oil Spill Populations

In 1988 there was an extensive oil spill from the Shell Oil Refinery in Martinez, Contra Costa County. In a survey of the area performed by Dave Showers of the Endangered Plant Program (EPP), four previously undocumented occurrences of *Lilaeopsis masonii*

were discovered, (Occ's H, I, J, and K). Unfortunately, two of these populations were heavily impacted by the oil spill, (Occ's H and K). It is not known at this time what effects the oil spill has had on these populations, nor is it known if other undocumented populations were also affected.

The oiled populations of *Lilaeopsis masonii* on Seal Island and Edith Point inhabit the most "down-river" extent of the species. They therefore experience (and perhaps tolerate), a higher salinity level than do the populations farther east in Suisun Bay and the Delta. A loss of these potentially most saline-adapted populations could have a devastatingly negative long term effect on the survival of the species. A survey of the area should be undertaken to locate other populations that may not have been previously known, and to locate other populations that may now be at risk because of the oil spill.

Napa River Occurrences

All of the Napa River sites are in immediate danger (CNDDB #10, 35, 36; Figures 6 & 16; Plates 16 & 17). These populations are small, and many of them are mainly found on old pilings or amongst riprap where enough sediment has accumulated to support their roots. All of the old pilings are rotting. When the pilings disintegrate, a good portion of the local populations will be lost. In addition, people were observed fishing at all sites, exposing the occurrences, especially at low tide, to trampling. This may explain, in part, why the populations at these occurrences are so small.

These very small and threatened ocurrences are probably the remnants of an historically much larger range of *Lilaeopsis masonii*. In addition, these occurrences may be distinct genotypes compared those found along the Sacramento and San Joaquin Rivers because they are relatively isolated from each other. Water salinity measurements for the three sites

we investigated on the Napa River were greater than 8.0 ppt., readings much higher than any measured in the Delta. As water diversion projects continue to impact the freshwater flow into the Delta, these salt tolerant populations may be an important allele reservoir needed to ensure the survival of the species.

Protection of the Napa River occurrences may include, but may not be limited to *in situ* conservation. Modification of the sites is also recommended, particularly restoration attempts. It is also recommended that a survey of all of the Napa River be done by boat to locate any potentially unrecorded populations, and to investigate the habitat for potentially transplanting individuals from the endangered populations to preserve the variation in the gene pool of *Lilaeopsis masonii.*

Type Locality on Sherman Island

The type location on Sherman Island is completely bounded by riprap and is at risk (CNDDB #7). One small area at this site has accumulated enough sediment at the water line to support a small population of *Lilaeopsis masonii* as well as *Limosella subulata.* It is not known if the original occurrence was larger when the species was first described. But because of the extensive riprap, any erosion of this location will certainly destroy this type locality, as there is no suitable, unoccupied habitat near by into which the occurrence can reestablish. In addition, as was mentioned previously, there is some confusion as to the exact location of the type locality.

Antioch/Pittsburgh Occurrences

Several of the locations near Antioch and Pittsburgh are at risk (CNDDB #1, 19, 31, 32; Figures 1, 2, & 8; Plates 10 & 15). All of these occurrences consist of small populations threatened by foot traffic. In addition, like the type locality, these populations are bounded

by riprap and thus have little possibility to expand laterally along the banks. For example, CNDDB #1 is located at the Antioch Dunes National Wildlife Refuge, a sensitive habitat that has several other rare and endemic plants and insects. This occurrence consists of several extremely small populations on old pilings and a few square inches of beach.

Two occurrences on Sherman Island near the Antioch bridge are at risk (CNDDB #8, 9; Figure 5). These occurrences, like many others that are at risk, are small populations bounded by riprap. It is interesting to note that one occurrence (CNDDB #8) was first discovered in 1954 at the base of the old bridge. The cement structure that used to support this old bridge has created a physical barrier both to erosion and from riprap, and thus a small population still exists. It should nevertheless be considered at risk for several reasons: 1) it is a small population, 2) it is very close to a PG&E underwater cable (any work PG&E may have to do to this cable could threaten this population), and 3) it is completely bounded by riprap that may prevent the population from increasing in size.

Several newly documented occurrences on Sherman Island (New Occurrences Q, R, S, and T) are also bounded by riprap. The DWR investigators wrote that more riprapping threatened all of the populations at these sites. Small newly documented occurrences on Brannon Island (McCarten 1989) are also at risk mainly due to foot traffic, as the populations are near a major swimming beach.

A new occurrence of *Lilaeopsis masonii* was found on Donlon Island Dredge Material Island (DMI) #6 and is threatened by a mid-sized individual of pampas grass *(Cortaderia selloana.)*. Also, DMI's have been recently created and it is not clear whether the substrate on which the populations are located are transient. Further monitoring of this site is recommended because it is less than 6 years old.

Upper San Joaquin River Occurrences

Water hyacinth *(Eichornia crassipes)* is dominating the littoral zone in much of the upper portions of the San Joaquin river and its tributaries. It appears to be in direct competition with *Lilaeopsis masonii* for suitable habitat. Water hyacinth was observed throughout this region growing in the littoral zone and also floating in the river and sloughs. It was also observed growing very close to the newly discovered *Lilaeopsis masonii* occurrence on Venice Island Cut . Overall, *Eichornia crassipes* is a significant threat to *Lilaeopsis masonii* and all other native plant species that grow in the littoral zone.

An occurrence of *Lilaeopsis masonii* at the confluence of the north and south forks of the Mokelumne River is endangered, along with occurrences all along the north fork of the Mokelumne River from the San Joaquin River upriver to the confluence of the Mokelumne and Cosumnes Rivers. We consider them endangered because of the proposed deepening and widening by DWR of that portion of the Delta (Stein 1990). Proposed mitigation by DWR for the destruction of *Lilaeopsis masonii* populations includes the creation of islands from existing levees. The quality of these levees for potential habitat has not been determined and the long term survival of these islands is unknown due to the associated increased bank erosion. This is particularly important because one of the main objectives of river modification by DWR is to increase river flows in those portions of the river.

It is interesting to note that *Lilaeopsis masonii* was not found on any of the islands investigated by us in the San Joaquin River watershed (23 islands on Old River, Bouldin Island quadrangle, and 20 islands on Old River and Middle River, Woodward Island quadrangle). Many of these islands appeared to be old levees where the river was widened like those DWR proposes to create. However, this modification history needs to be

verified. Nevertheless, destruction of occurrences on the San Joaquin River drainage where few extant populations of *Lilaeopsis masonii* survive should not be permitted unless it can be proven that transplantation to the kinds of islands proposed by DWR can be shown to support *Lilaeopsis masonii* in perpetuity.

V.C. Areas Needing Further Investigation

The Napa River drainage should be explored by boat to locate more occurrences of *Lilaeopsis masonii*. There are probably more populations that have not been documented within this drainage, largely because of the difficulty in reaching the shoreline within many parts of the river. The investigation should therefore be primarily done by boat.

Most of Suisun Marsh is potential habitat for *Lilaeopsis masonii* and should also be explored by boat (preferably not during the hunting season.) This is another area that probably supports more occurrences of *Lilaeopsis masonii* that haven't been documented due to the difficulty in reaching the littoral zone, except by boat. In addition, all marsh shoreline surrounding Suisun Bay should be explored. The largest and most isolated populations of *Lilaeopsis masonii* have been found on the islands in this bay. Documentation and protection of occurrences here is most crucial. Many of these sites endure little or no impact from human modification (except water chemistry, *e.g.*, pollutants, salinity, *etc.*), and therefore provide the best suitable habitat for preserving and maintaining the species.

More of the San Joaquin River watershed should be explored. Although we surveyed over 40 islands in this region, the survey represents a fraction of the total area. Few occurrences are known from this area and all occurrences in this region should therefore be considered extremely endangered particularly because there are more plans by DWR to further modify the San Joaquin River drainage (Buer 1990). It is not recommended that any occurrences within the San Joaquin

River watershed be permitted to be modified, because occurrences in this portion of the species' geographic distribution may be close to extinction. Specifically, we strongly recommend against mitigation of lost habitat by the transplantation of impacted plants. If the destruction of an extant population is necessary, then it should not be initiated until after it is demonstrated that the receptor site can sustain transplanted populations for no less than 5 years.

Portions of the Sacramento River watershed should be further explored, as some of the newly documented occurrences have been found in this area. *Lilaeopsis masonii* occupies the littoral zone of freshwater tidal marshes in the riparian woodlands in portions of this watershed. Indeed, some of the most unique habitat left is in this region. Documentation of what remains of this marsh/riparian habitat is essential in any comprehensive study of the ecology and distribution of *Lilaeopsis masonii.*

V.D. Current Mitigation Efforts

In 1988, DWR transplanted *Lilaeopsis masonii* to mitigate for the destruction of eight populations during rock revetment work along Barker Slough in Solano County (ECOS 1988). According to Niall McCarten, 18 of the original 20 transplanted populations are viable after two years (McCarten pers. com). McCarten feels that more site manipulation will be needed to protect those surviving populations from further destruction from erosion. However, two years of monitoring is insufficient to determine if transplantation has been successful. Although the project will be considered successful if 80% of the transplants survive for 5 years (McCarten pers. comm.), we agree with McCarten that this may not be enough time to fully evaluate the transplanted populations' resilience and "adaptation" to a new site.

During the past 5 years California has experienced a prolonged drought. As such, runoff from the Sacramento River and its tributaries has been greatly reduced. Therefore, sites that now harbor the

transplanted populations have likely not experienced normal erosional events expected from rainfall or spring runoff during a normal precipitation year. Until these populations are shown to be able to tolerate such events, any arbitrary monitoring period that does not contain at least one normal precipitation year should not be viewed with confidence. Again, we recommend that destruction of habitat be allowed only after transplanted populations have been proven to be able to persist at the new locations and under a long enough time period to be exposed to most of the natural processes that impact any given site. These processes include erosion, as well as periods of drought and high precipitation years.

In addition, excessive precipitation events like the one that occurred in 1986 when several Delta Islands were flooded can be expected to occur relatively frequently. These wet years will cause more than usual erosion along riverbanks and may be the reason that seemingly good potential habitat does not support *Lilaeopsis masonii*. Sites that appear to be good locations for *Lilaeopsis masonii*, but that do not actually support it, should be critically evaluated before considering them as potential transplant sites. Because the ecology of *Lilaeopsis masonii* is poorly understood there may be sound (but unknown) ecological reasons why it is not found at sites that appear to be of high quality. Also, because its present distribution must be less than 5% of its historical range (Atwater *et al.* 1979), there may be barriers to its dispersal and establishment that makes present habitat all the more precious.

For example, the habitat that supports *Lilaeopsis masonii* in the Barker's Slough region is a tidal marsh that is undergoing constant bank slumping, habitat in which *Lilaeopsis masonii* occurs. This active slumping of the substrate is probably an important process upon which *Lilaeopsis masonii* is dependent. Bank erosion not only destroys *Lilaeopsis masonii* habitat, but also opens up new habitat that *Lilaeopsis masonii* can colonize. In fact, those areas that do not undergo active erosion may eventually become dominated by plants other than *Lilaeopsis masonii* such as *Scirpus*

spp., *Alnus rhombifolia*, *Salix* spp. *etc.* *Lilaeopsis masonii* can persist underneath these canopies, but not in the same densities as in open, actively eroding environments. There must be a balance between habitat stability and erosion, but not so much that large areas are wiped out during natural disturbances such as floods. Therefore, any project that seeks to mitigate the loss of *Lilaeopsis masonii* habitat by transplantation alone must ensure that the new site is subjected to the same process that support existing populations. This includes having suitable reservoir populations of *Lilaeopsis masonii* in the immediate area that will serve as a source for the colonization of actively eroding sites. Areas that support > *masonii* and are destroyed may be recolonized as long as there are nearby reservoir populations able to disperse to these disturbed sites, and the processes that support *Lilaeopsis masonii* habitat still exist in the region.

In summary, it is still not clear whether the destruction of populations of *Lilaeopsis masonii* and the subsequent creation of habitat via transplanted populations as mitigation is beneficial to the long term survival of the species. There is little natural habitat remaining in the Sacramento drainage and even less in the San Joaquin River drainage. Care must be taken to ensure that populations can be transplanted successfully before extant populations are destroyed. Observation to determine success in transplants must take into account precipitation history and not just an arbitrary time period, because precipitation, flooding, and erosion events that effect *Lilaeopsis masonii* are dynamic, episodic and not periodic. Therefore predictions about long-term viability cannot be made over short periods of time.

V.D.1 Dredge Material Islands

As part of the widening and deepening of the Stockton Deep Water Ship Channel (SDWSC), the U.S. Army Corp Of Engineers (USACE) created several dredge material islands (DMI) in open water within breached, abandoned levees at Donlon and Venice Cut Islands (England *et al.* 1990). Donlon Island is located in southwestern Sacramento

County approximately 2.0 miles northeast of Antioch. Venice Cut Island is located in western San Joaquin County approximately 15.0 miles northwest of Stockton. Creation of nine DMI's totaling 58.0 acres on Donlon Island was completed in 1985. The creation of a single 23.0 acre DMI at Venice Cut Island was completed in 1986.

Vegetation was not planted at any of the DMI's and therefore all colonization on the DMI's is occurring naturally. This provides an interesting opportunity to determine if this kind of habitat creation can be colonized naturally by native Delta plants such as *Lilaeopsis masonii* . Although DWR has surveyed these islands several times in the past few years, neither *Lilaeopsis masonii* nor any other rare Delta plants have been found by them. However, our investigation of Donlon Island did record a new occurrence of *Lilaeopsis masonii* on one of the DMI'S.

In November 1990 we surveyed Venice Cut Island for *Lilaeopsis masonii* but were unable to locate any occurrences. Although a reservoir occurrence was discovered only a few hundred meters from the DMI within the flooded island (this was also a new sighting - Occ. F), it did not appear that, four years after construction, *Lilaeopsis masonii* was able to colonize the Venice Cut Island DMI.

There are at least three reasons for the failure of the Venice Cut Island DMI to be colonized by *Lilaeopsis masonii*. First, most of the substrate at the Venice Cut Island DMI appears to be sandy and unstable. As noted earlier in the report, *Lilaeopsis masonii* does not appear to establish well on a sandy substrate. Second, the substrate of which the DMI was composed appears to be shifting, suggesting that much of the littoral area is transient. Third, the mouth of the island is still flooded and opens out to the SDWSC. Because the only nearby population of *Lilaeopsis masonii* is opposite this opening, all wind and water

currents flow from the DMI toward the extant population of *Lilaeopsis masonii*. These currents would need to flow in the opposite direction for the extant occurrence to be able to colonize the DMI.

In January 1991, we surveyed one of the nine Donlon Island DMI's (DMI #6) for *Lilaeopsis masonii* (Figure 2 & 20). We discovered one occurrence of *Lilaeopsis masonii* growing underneath a canopy of grasses and herbs (Occ. G). The plants were growing on a silty substrate suggesting that the sandy DMI is accumulating sediment. A silty or clay substrate appears to be the preferable substrate for *Lilaeopsis masonii* habitat rather than sand. Ttides were not favorable that day so we did not have sufficient time to extensively characterize or evaluate this site. Nevertheless, this discovery is important as the population would have to have been established naturally within the last five years. The surrounding islands in Suisun Bay contain the largest and most natural populations of *Lilaeopsis masonii* and so reservoirs for dispersal and colonization are readily available. However, the present populations of *Lilaeopsis masonii* cannot be judged to be stable or permanent as the DMI appears to be undergoing dynamic vegetation and substrate modification due to natural forces.

The discovery of *Lilaeopsis masonii* on the Donlon DMI #6 illustrates great potential for mitigation and also population expansion. Just west of Donlon Island is a relatively large flooded portion of western Sherman Island where more DMI's could be created. As this part of the Delta contains the largest populations of *Lilaeopsis masonii* (and probably the least endangered populations), creation of more DMI's and research on their effects on the vegetation and wildlife of the Delta should be a high priority among all agencies mandated to protect imperiled terrestrial species and habitat in the Delta. Because many of the natural processes that sustain suitable habitat for *Lilaeopsis masonii* function in Suisun Bay,

creation of more habitat in this region of the Delta is recommended. If, after an appropriate period of time, it is proven that the newly created DMI's can be naturally colonized by *Lilaeopsis masonii*, mitigation that creates new habitat might be acceptable, especially if current transplanting studies do not prove to be successful.

Overall the attractive aspect of DMI creation is that it provides new habitat. If *Lilaeopsis masonii* naturally colonizes a DMI, as it apparently has at Donlon Island, there is a good chance that it will survive and tolerate processes that impact the new location. Mitigation for the loss of habitat might be viewed as successful if, within 5 years, a newly created habitat has been colonized naturally by *Lilaeopsis masonii* and then survives 5 years at the new site. Because there are more variables involved in natural processes than current technology can measure, any mitigation effort that incorporates natural colonization as the method to populate a new site should be given priority.

VI. SUMMARY

Lilaeopsis masonii appears to be more widespread than documented by the CNDDB. Newly documented occurrences are found mostly in regions accessible by boat only; therefore, in terms of accessibility, they are largely unthreatened by human activity. This species appears to grow on a wide variety of substrate, but it typically is found growing amongst the exposed rhizomes of *Scirpus californicus* in association with *Hydrocotyle verticillata* var. *triradiata*, *Scirpus cernuus* var. *californicus*, and occasionally *Limosella subulata*. Associated near shore vegetation typically includes *Salix* spp., *Rubus procerus*, *S. californicus*, *Helenium bigelovii*, and *Lythrum californica*.

Limosella subulata was rarely encountered during the survey, and appears to be even more narrowly distributed than *Lilaeopsis masonii*. Because it inhabits the same habitat as *Lilaeopsis*

masonii and yet is even more rare in its West Coast distribution (occurring only in a few known locations within the Sacramento-San Joaquin Delta), *Limosella subulata* should receive some form of legal protection.

As mentioned previously, Suisun Bay was found to support habitat with the largest and healthiest populations of *Lilaeopsis masonii* . Because there appears to be little human activity on the islands within Suisun Bay it might be feasible to purchase these islands or to include them into a larger wildlife preserve. In addition, because successful mitigation is unproven for *L. masonii*, these large and relatively isolated populations of *Lilaeopsis masonii* may very well harbor the only individuals that can survive further Delta modification into the 21st century. Protection of these habitats and the natural processes that interact with the edaphic and climatic conditions of the area should be of prime importance in any projects undertaken to ensure the survival of this species.

We recommend further surveys near the periphery of this species' known range to document completely its range of habitats, and to understand better its ecological requirements. Continued existence of many *Lilaeopsis masonii* populations is clearly threatened by modifications of the levee system of the Sacramento-San Joaquin Delta, deep-water channel dredging, and recreational human activities that involve trampling of the shoreline. Clear potential threats include changes in water quality that involve changes in salinity, heavy metal concentrations, and oiling by local refineries or shipping accidents.

Despite over 20 additional populations documented, we recommend a change in status by the California Department of Fish and Game Commission, from "rare" to "threatened." This is because: 1) *Lilaeopsis masonii* naturally inhabits unstable and ephemeral littoral habitat that is under considerable threat through human manipulation; 2) the extent of sexual reproduction is unknown and may be extremely limited; 3) its current geographic range is severely fragmented, as

illustrated by collection information that ranges from Tomales Bay (Marin County) to the interior portions of the Delta (Stanislaus County); it likely is representative of a much broader geographic range; 4) the only coastal population (and possibly the most saline tolerant) at Tomales Bay has apparently been extirpated; and, 5) *Lilaeopsis masonii* appears to colonize new habitat both up and down river by ramet fragmentation and dispersal via tidal action within the Sacramento-San Joaquin Delta. This method of dispersal may be threatened with additional water diversions resulting in changes of water movement and water quality.

In summary, we recommend that further studies should include: 1) an intensive survey of the entire historical range of *L. masonii*; 2) a study of the genetic variation among and between the populations of *Lilaeopsis masonii*; 3) an investigation of the effects of crude oil on the biology of the species; 4) an investigation of the reproductive ecology of *L. masonii*; and 5) further studies on the potential for transplantation of this rare species on dredge material islands as mitigation.

VII. ACKNOWLEDGEMENTS

We wish to thank Ed Pearson and S. Jonathan Stern for their skillful assistance and handling of the boat in the treacherous waters of the Carquinez Straits and the Sacramento-San Joaquin Delta. We also wish to thank our field assistants Alisya Galo, Fidel Peña, and Randy Zebell for their able assistance. Finally, we are grateful to Ann Howald of the Endangered Plant Program for her considerable patience.

VIII. REFERENCES CITED

Affolter, J.M. 1985. A monograph of the genus *Lilaeopsis* (Umbelliferae). Systematic Botanic Monographs Vol. 6. 140 pp.

Atwater, B.F., S.G. Conard, J.N. Dowden, C.W. Hedel, R.L. MacDonald, and W. Savage. 1979. History, landforms, and vegetation of the estuary's tidal marshes. Pp. 347-385, in: *San Francisco Bay, the Urbanized Estuary*. T.J. Conomous (ed.). Pacific Division of the American Association for the Advancement of Science. San Francisco,CA.

Buer, S. 1990. Environmental Impact Report. North Delta Program. California Department of Water Resources.

California Department of Fish and Game. 1990. Designated endangered, threatened, or rare plants. Natural Heritage Division, Endangered Plant Program, March 1990.

ECOS, Inc. 1988. Experimental design for a transplant study of Mason's Lilaeopsis. Consultant's report prepared for the U.S. Bureau of Reclamation and the Department of Water Resources, Central District.

ECOS, Inc. 1990. Sensitive species survey report for the North Delta Water Management Project. Consultant's report for the U.S. Bureau of Reclamation and the Department of Water Resources, Central District.

England, S.A., Soggie, M.A., and Naley, M. 1990. Design and biological monitoring of wetlands and riparian habitats created with dredged materials. Final report, U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service, Sacramento, CA.

Mason, H.L. 1969. *A flora of the marshes of California*. University of California Press, Berkeley.

Mathias, M.E. and L. Constance. 1977. Two new local Umbelliferae (Apiaceae) from California. Madroño *24*: 78-83.

McCarten, N.F. 1989. Report on a study of sensitive plant species in the littoral zone of Brannan Island State Recreation Area. California Department of Parks and Recreation, Inland

region. Lodi, CA.

McCarten, N.F. 1990. Report on a study of sensitive plant species occurring in Frank's Tract State Recreation Area. Consultant's report prepared for the California Department of Parks and Recreation, Inland region. Lodi, CA.

Munz, P.A. 1973. *A california flora and supplement.* (supplement by D.D. Keck). University of California Press, Berkeley.

Smith, J.P., Jr. and K. Berg. 1988. *Inventory of rare and endangered vascular plants of California.* California Native Plant Society Special Publication No. 1, Fourth ed.

APPENDIX A: FIGURES

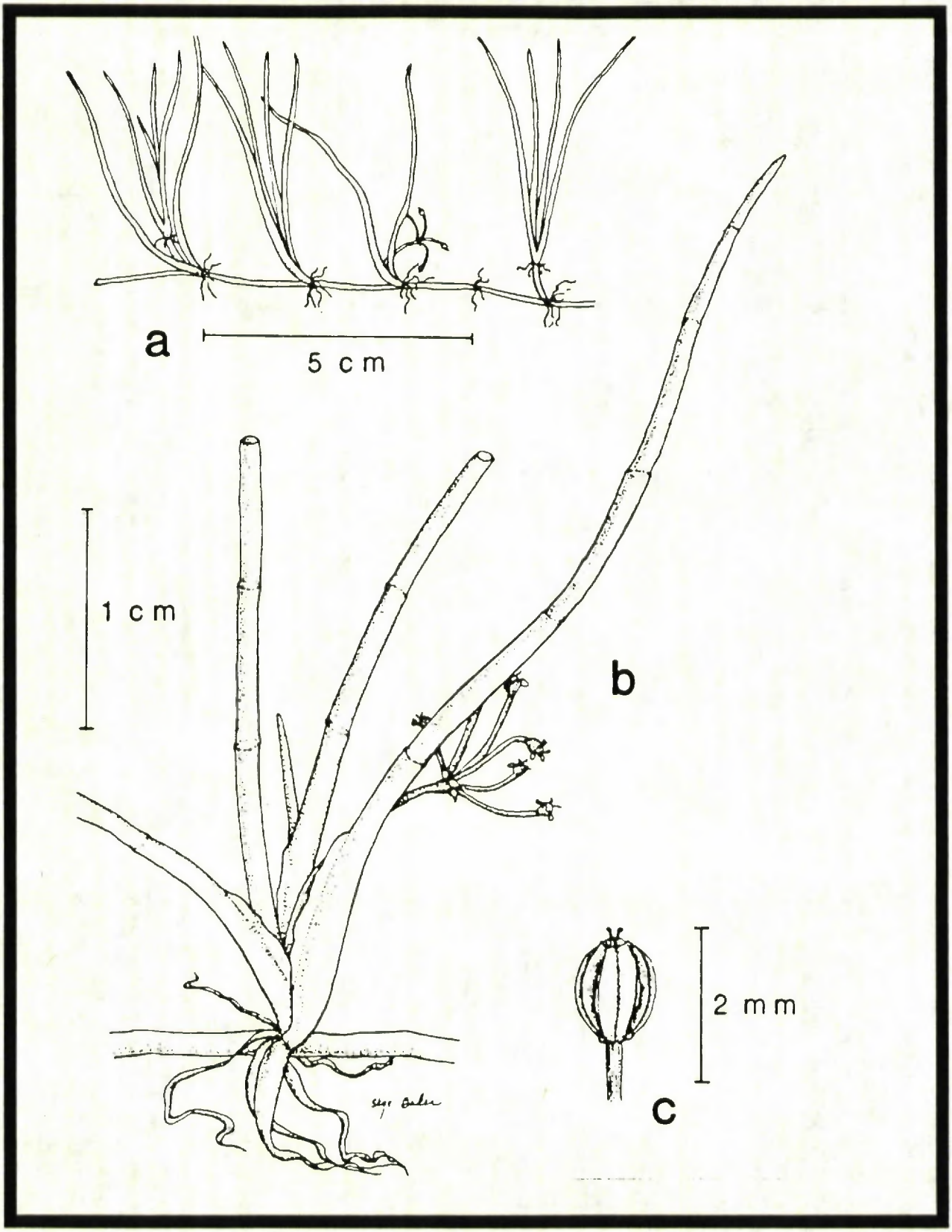


FIGURE 1. Drawing of *Lilaeopsis masonii*. (Source: Mathias and Constance 1977).

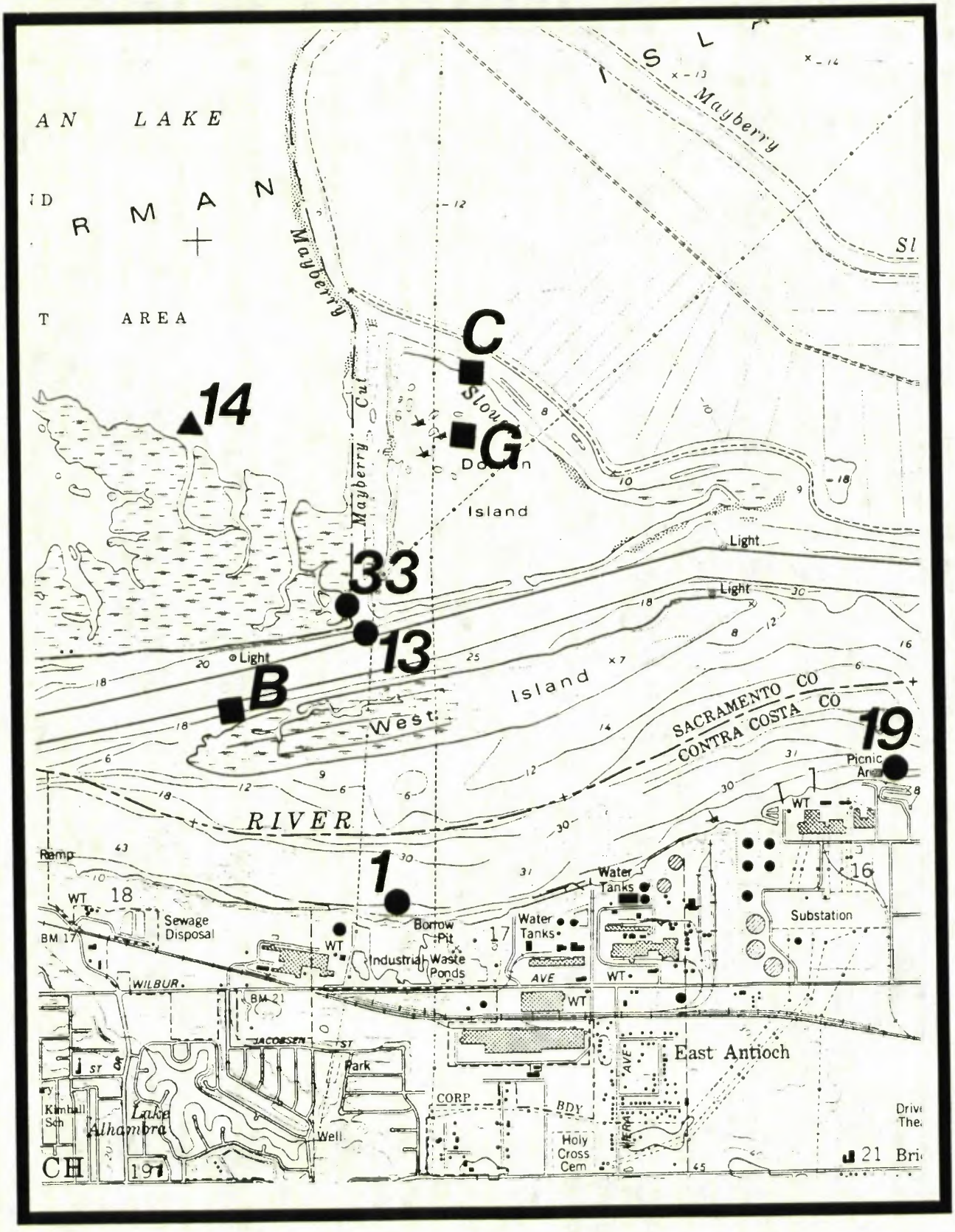


FIGURE 2. Location of CNDDB Occurrences 1, 14, 19, & 33, and new Occurrences B,C, & G. (Source: USGS Quad 7.5" Sheet Antioch North, scale 1: 24,000).

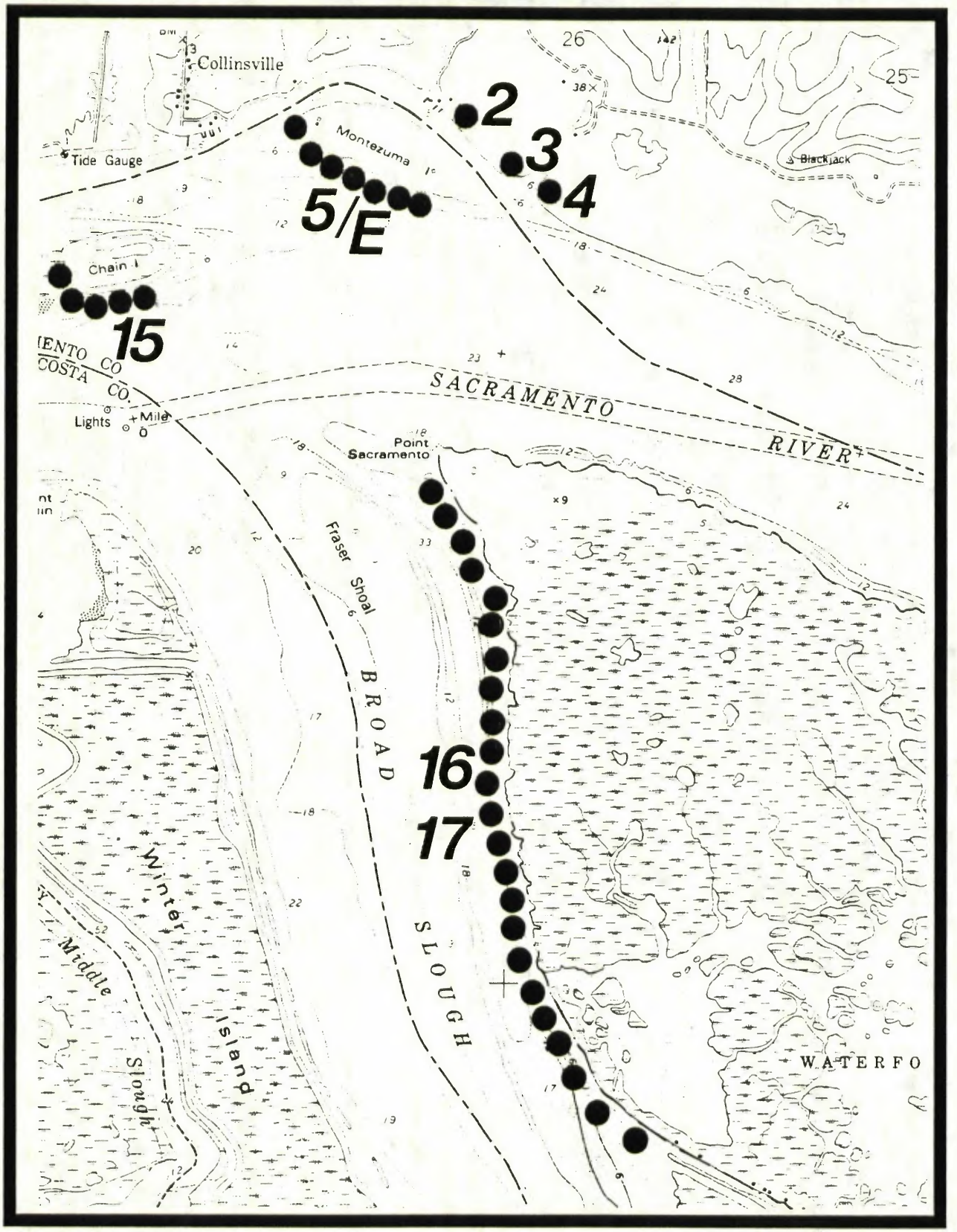


FIGURE 3. Location of CNDDB Occurrences 2,3,4, 5, 15, 16, & 17 and new Occurrence E. (Source: USGS Quad 7.5" Sheet Antioch North, scale 1: 24,000).

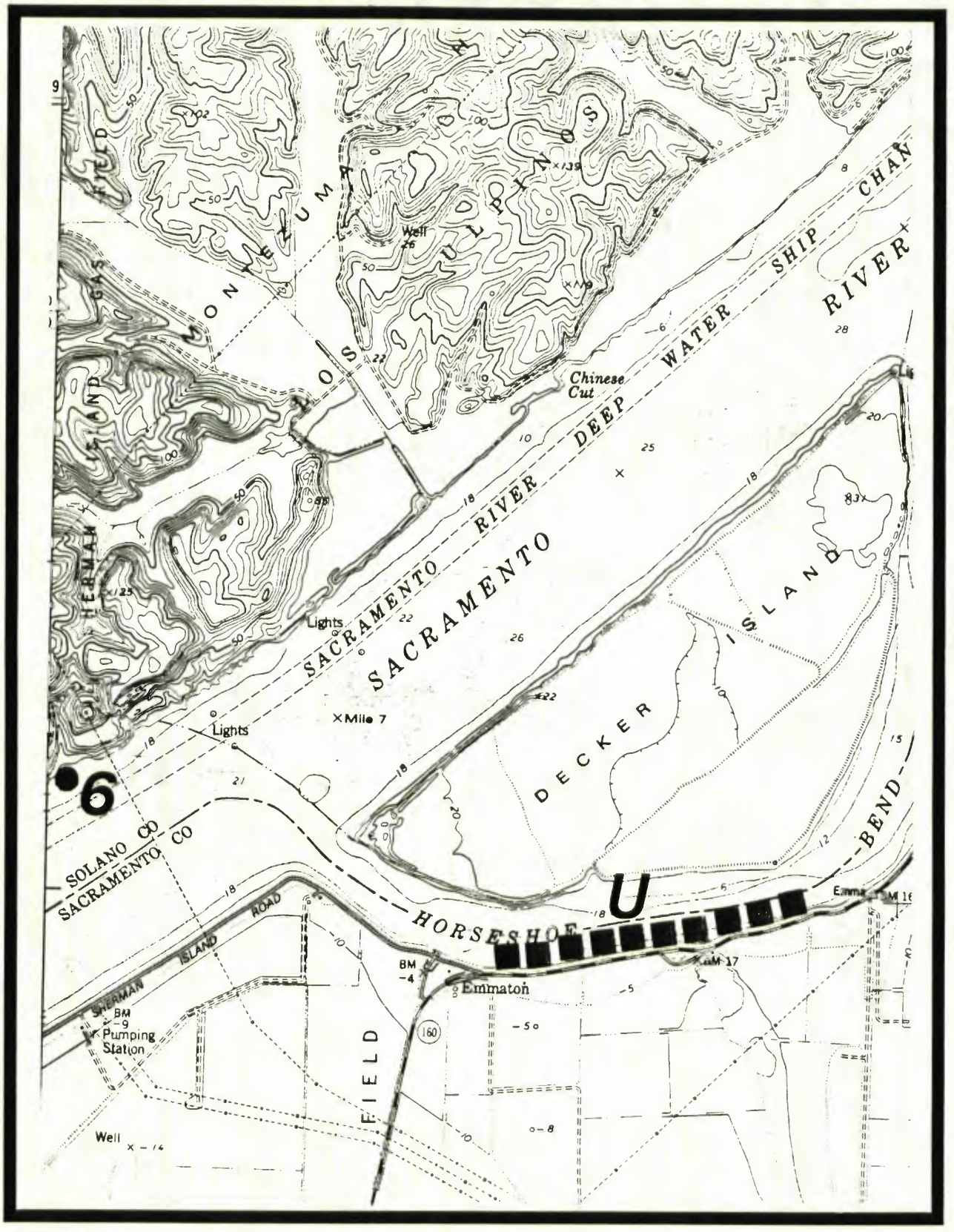


FIGURE 4. Location of CNDDB Occurrence 6 and new Occurrence U. (Source: USGS Quad 7.5" Sheet Jersey Island, scale 1: 24,000).

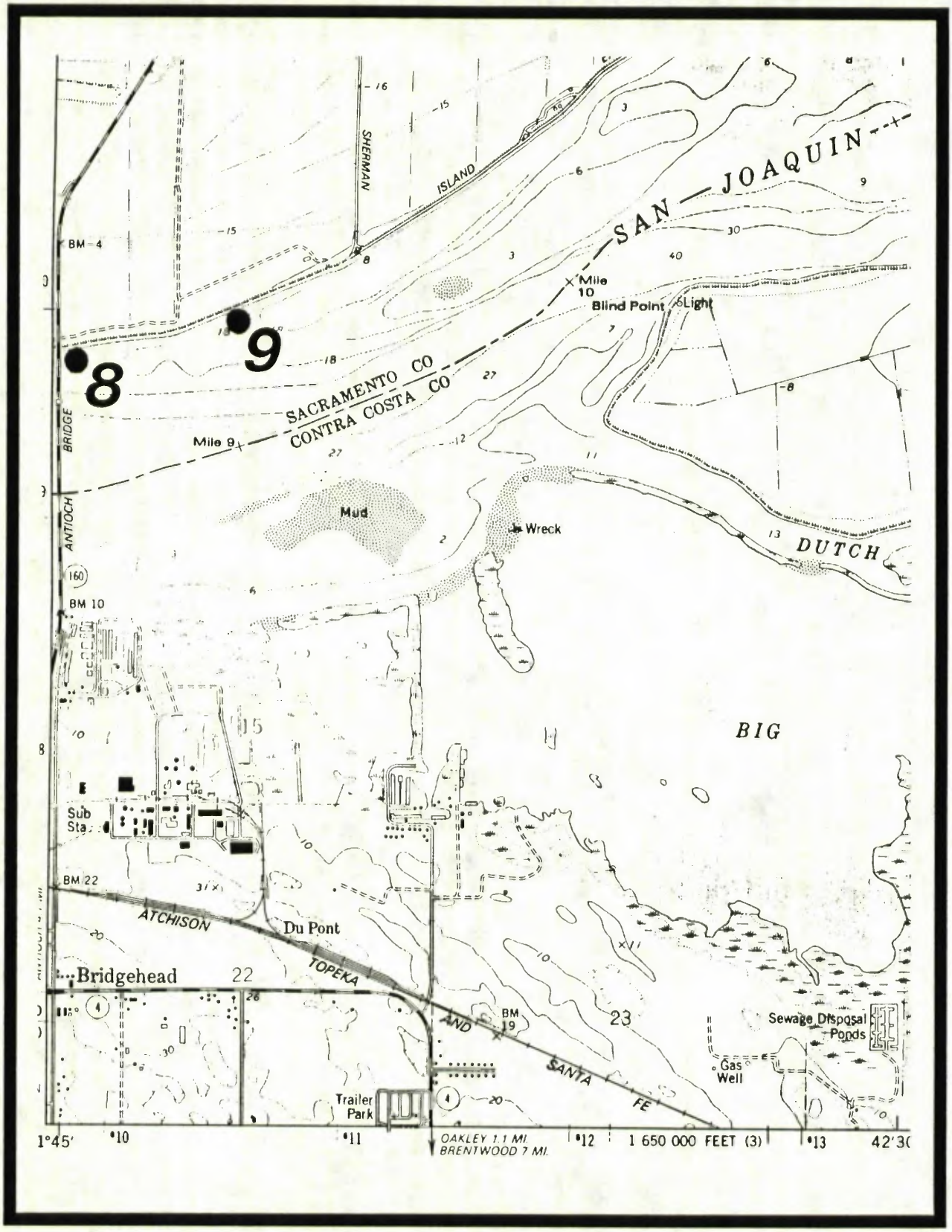


FIGURE 5. Location of CNDDB Occurrences 8 & 9. (Source: USGS Quad 7.5" Sheet Jersey Island, scale 1: 24,000).

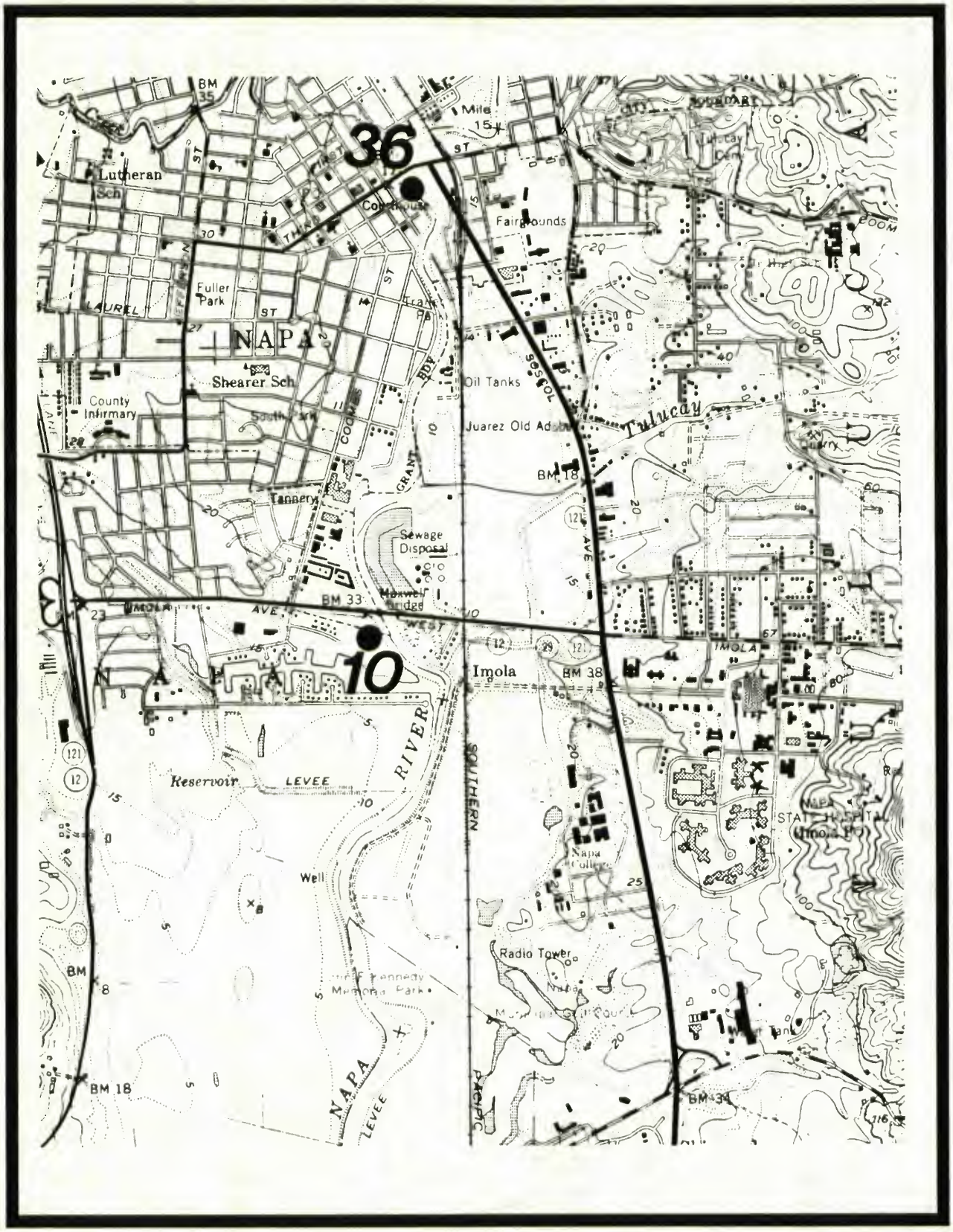


FIGURE 6. Location of CNDDB Occurrences 10 & 36. (Source: USGS Quad 7.5" Sheet Napa, scale 1:24,000).

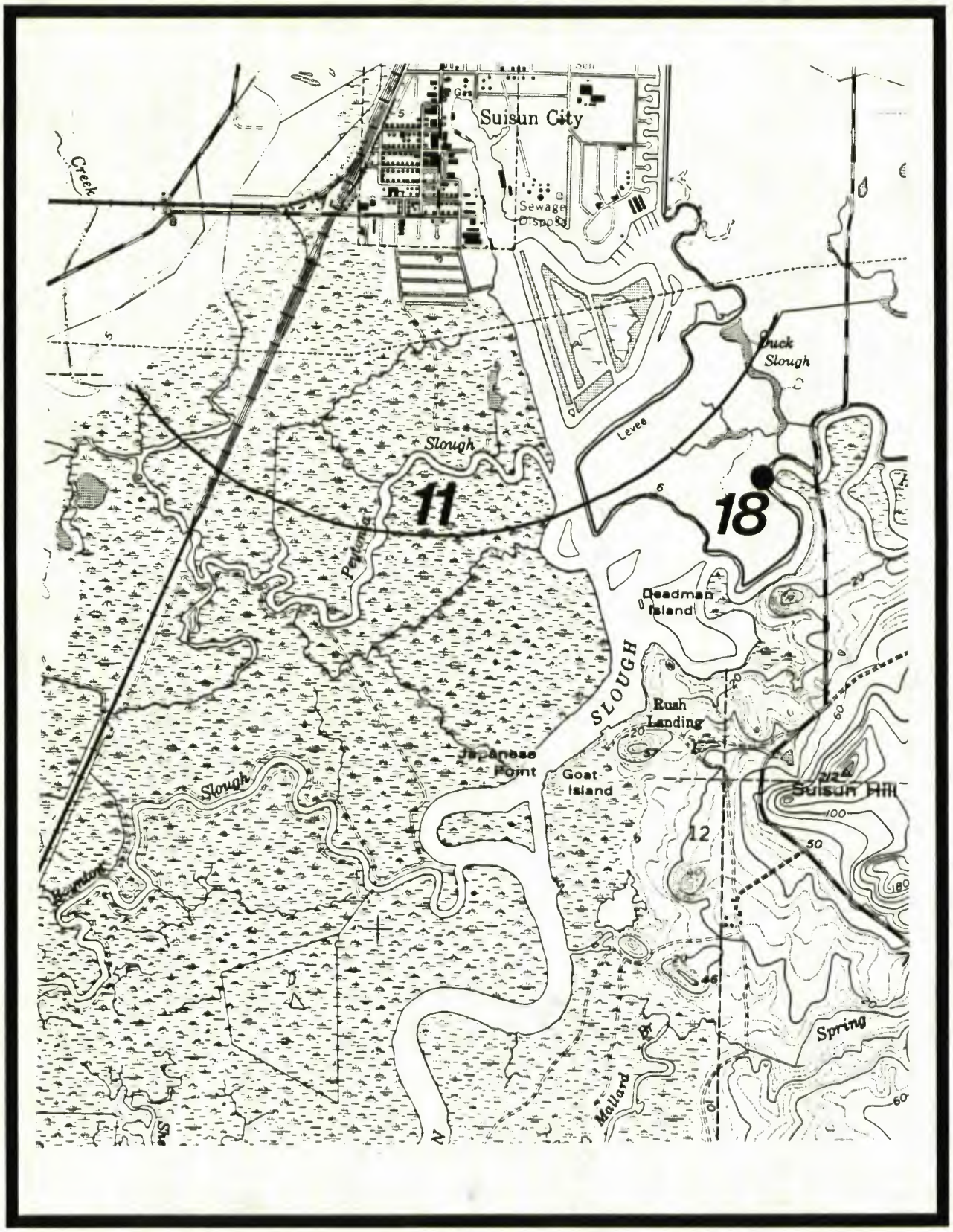


FIGURE 7. Location of CNDDB Occurrences 11 & 18. (Source: USGS Quad 7.5" Sheet Fairfield South, Scale 1: 24,000).

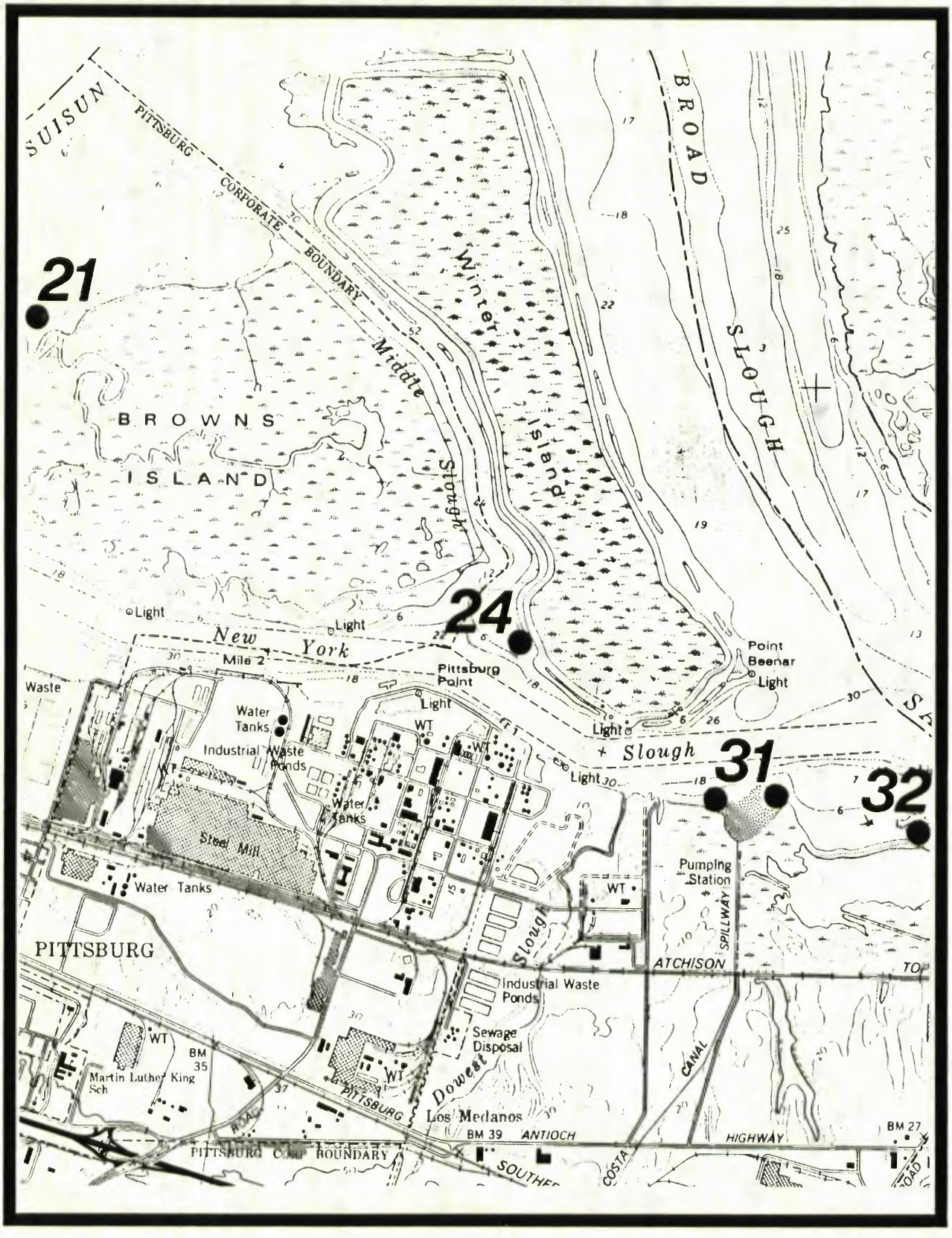


FIGURE 8. Location of CNDDB Occurrences 21, 24, 31, & 32. (Source: USGS Quad 7.5" Sheet Antioch North, scale 1: 24,000).

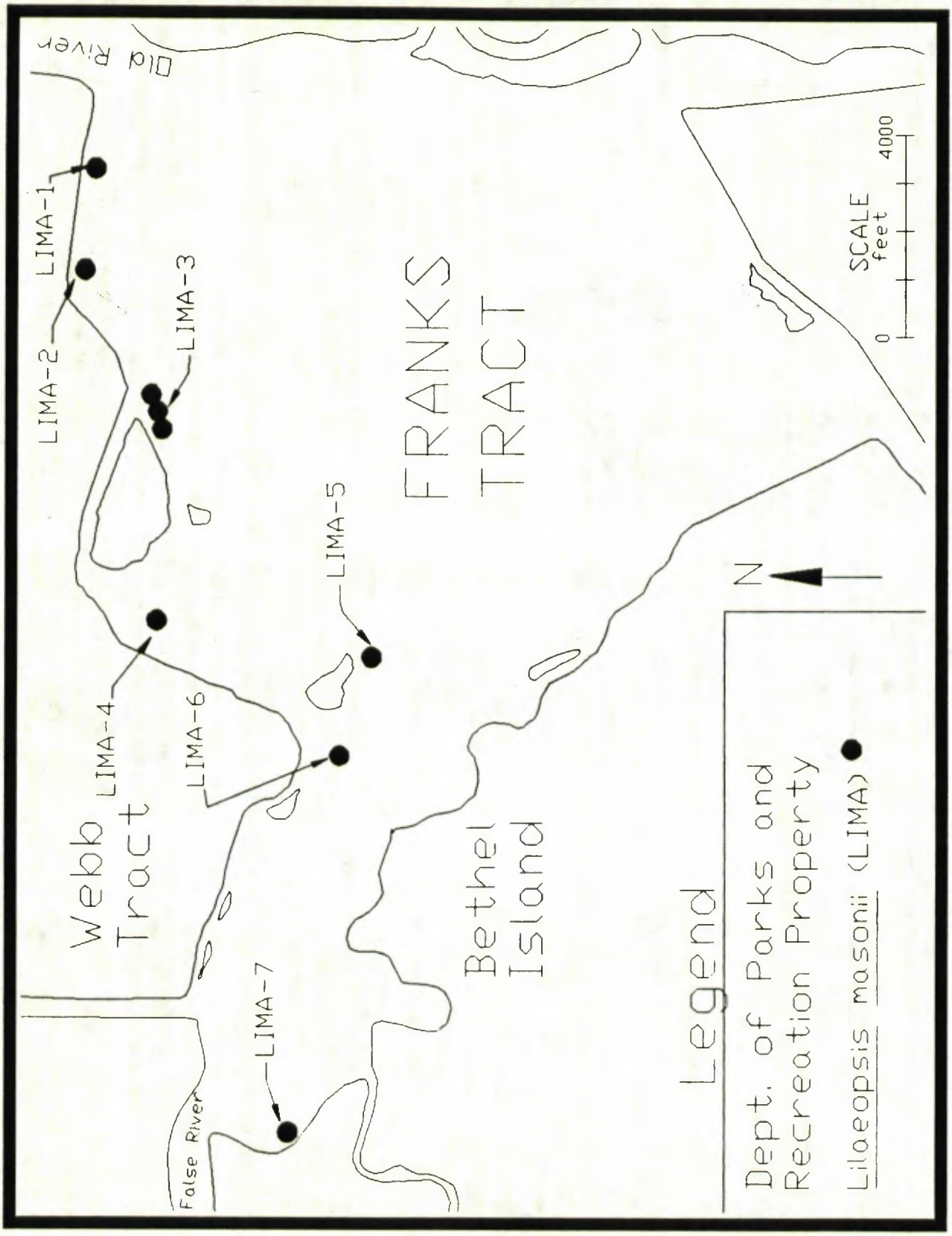


FIGURE 9. Location of CNDDB Occurrence 22 (Source: McCarten 1990, scale 3.5 cm: 4000 ft.).

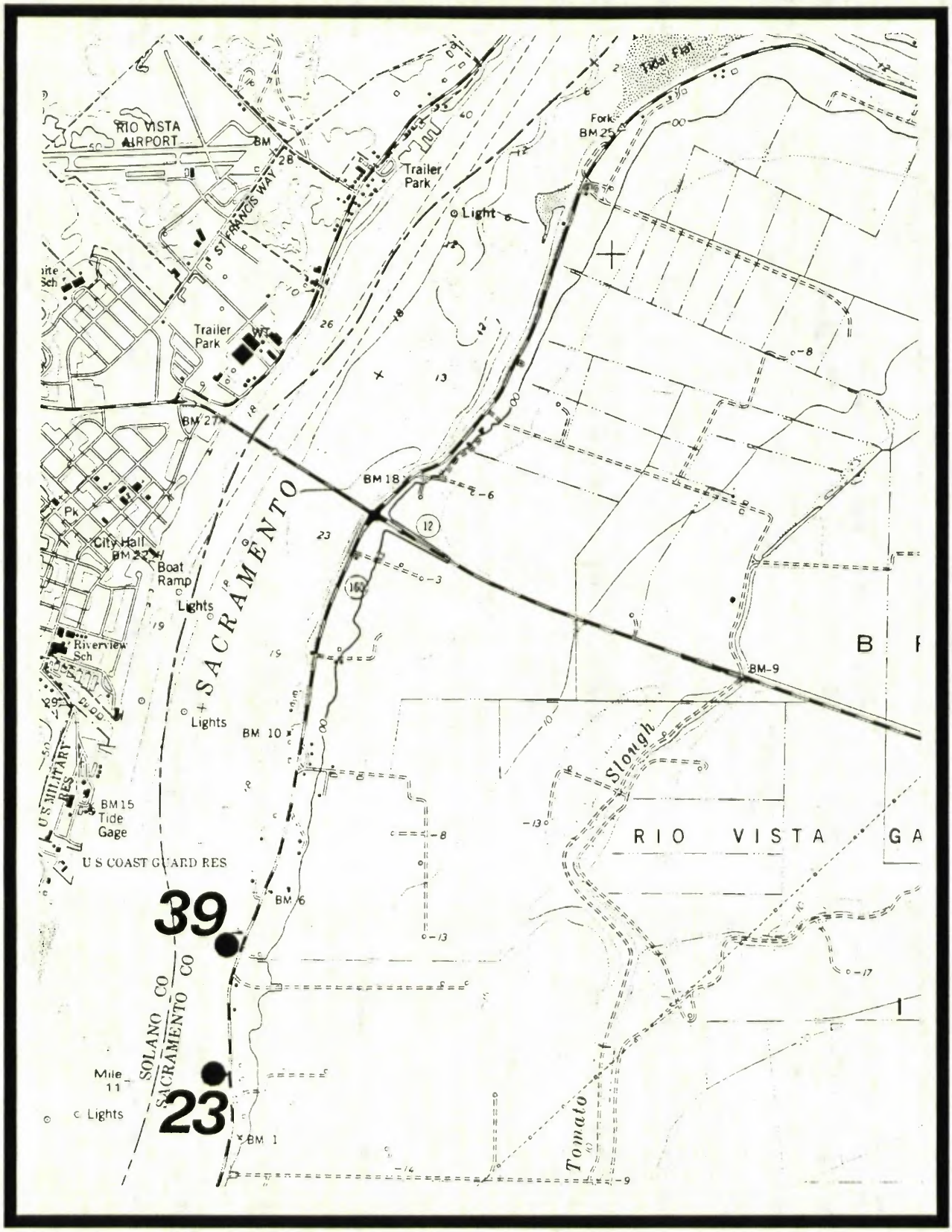


FIGURE 10. Location of CNDDB Occurrences 23 & 39. (Source: USGS Quad 7.5" Sheet Rio Vista, scale 1: 24,000).

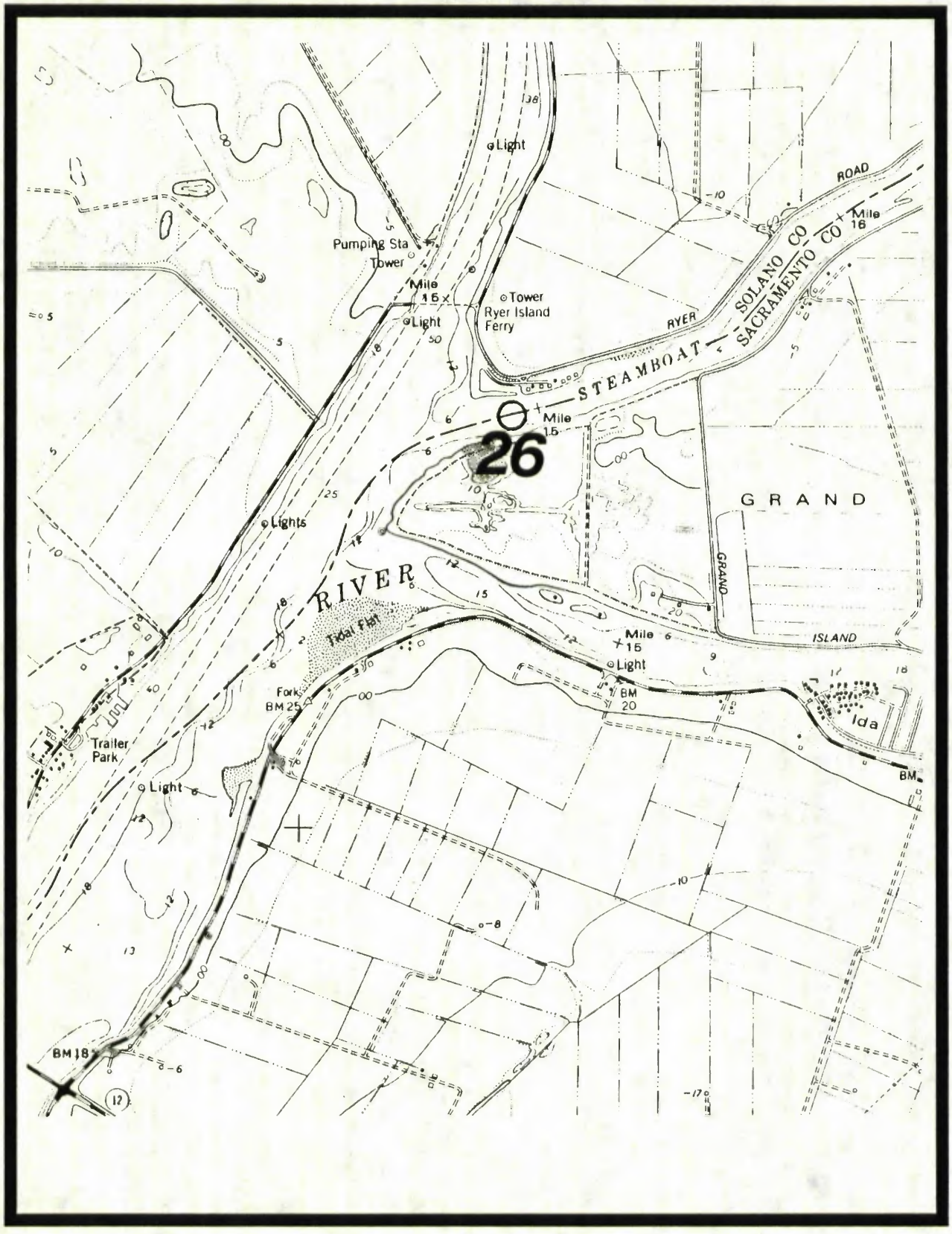


FIGURE 11. Location of CNDDB Occurrence 26. (Source: USGS Quad 7.5" Sheet Rio Vista, scale 1: 24,000).

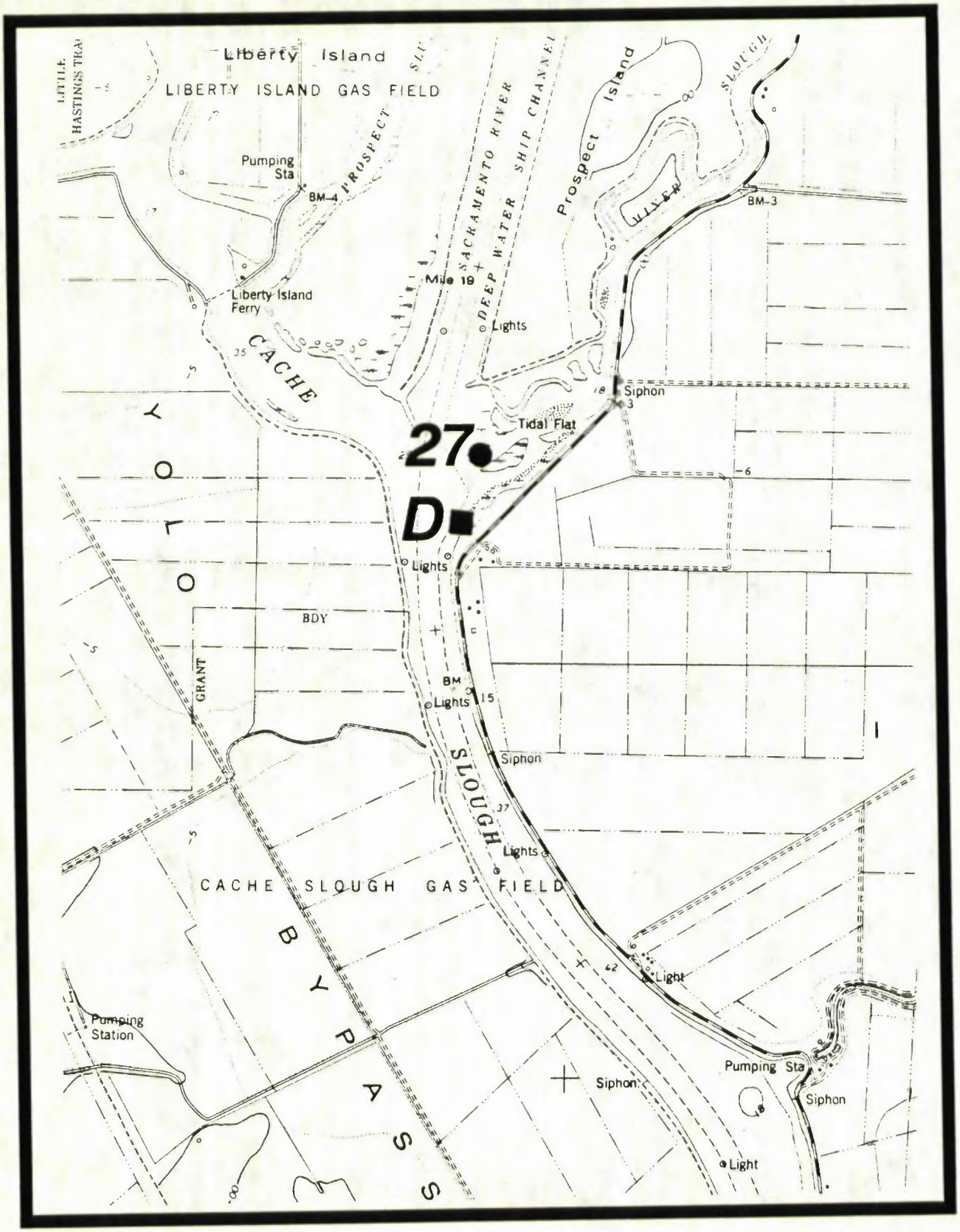


FIGURE 12. Location of CNDDB Occurrence 27 and new Occurrence D. (Source: USGS Quad 7.5" Sheet Rio Vista, scale 1: 24,000).

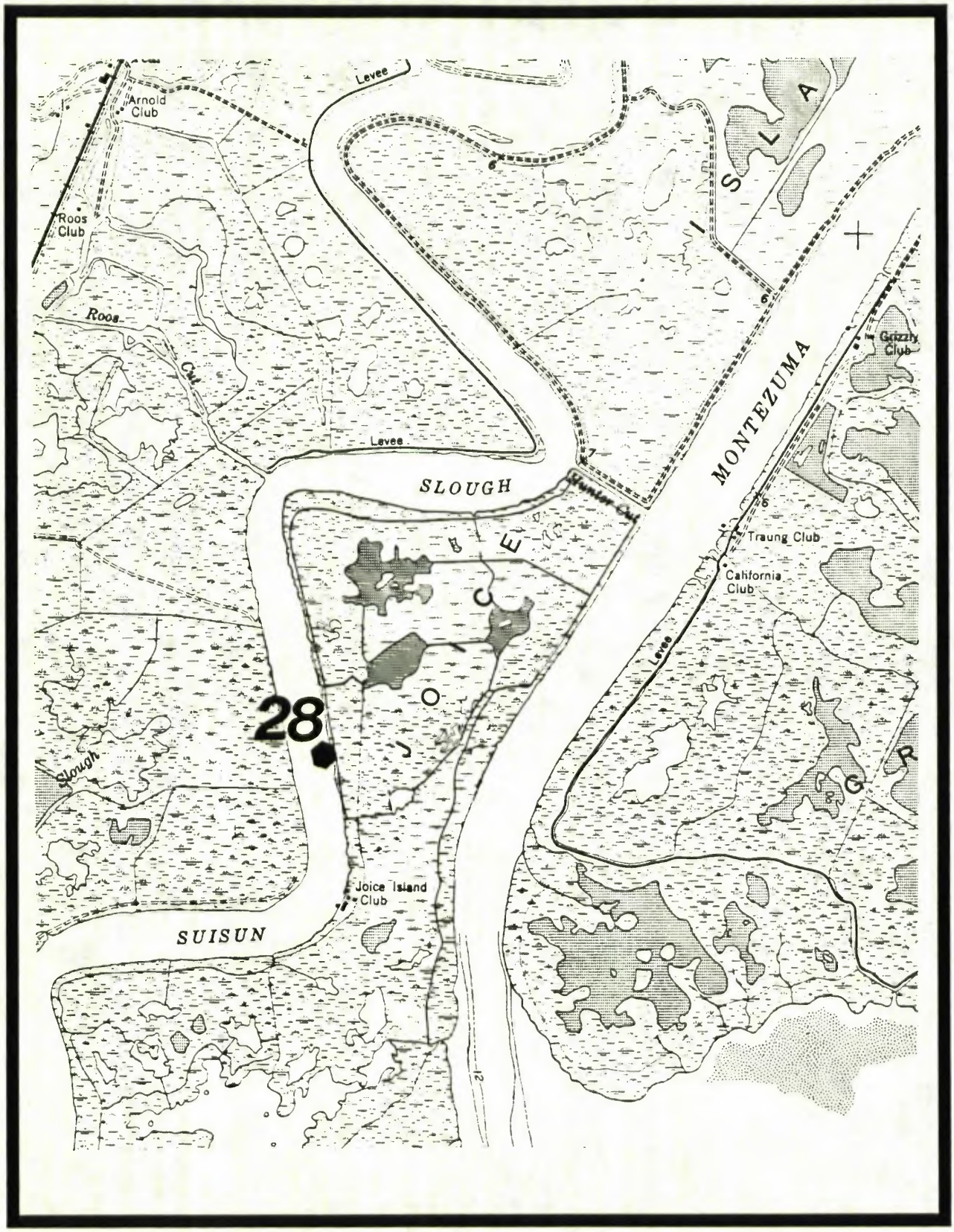


FIGURE 13. Location of CNDDB Occurrence 28. (Source: USGS Quad 7.5" Sheet Fairfield South, scale 1: 24,000).

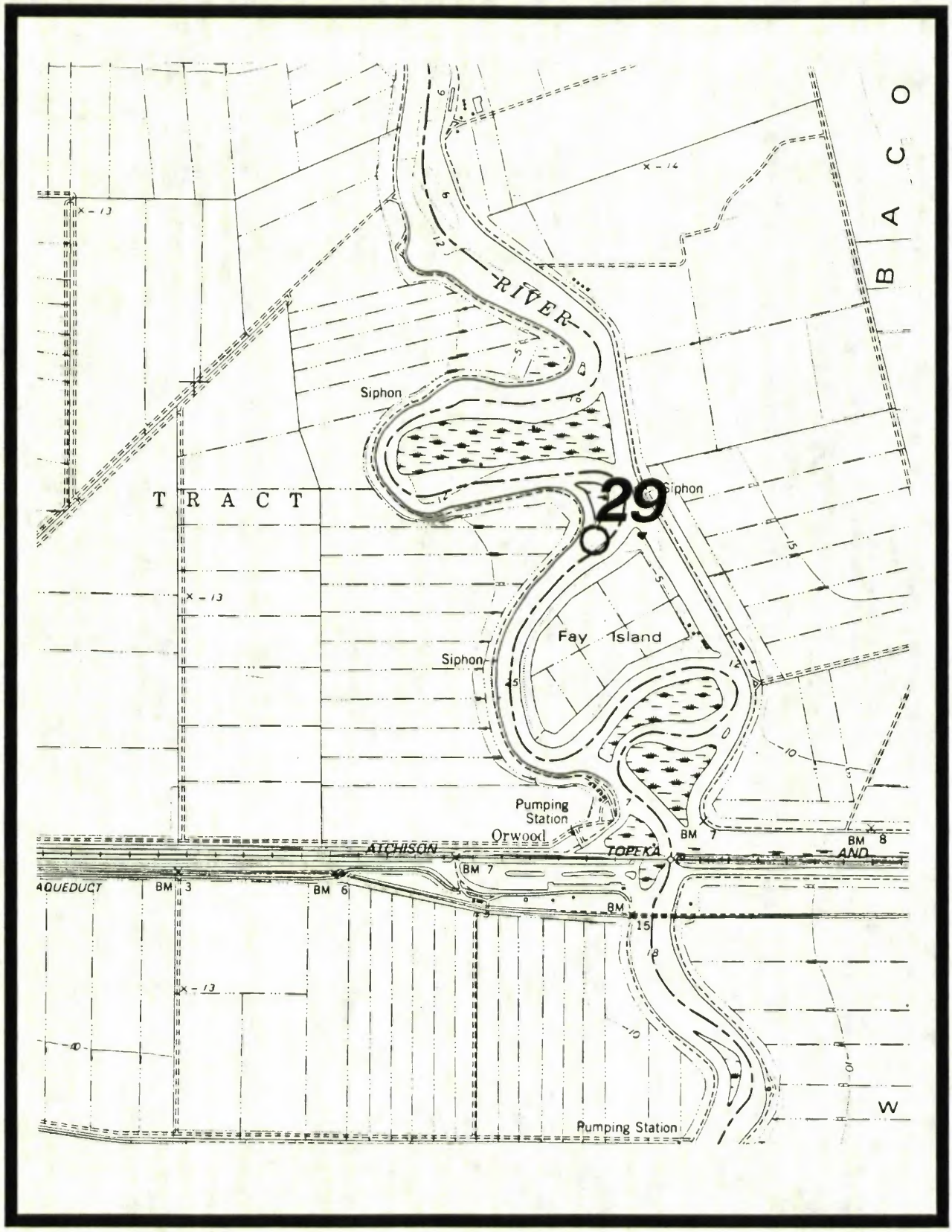


FIGURE 14. Location of CNDDB Occurrence 29. (Source: USGS Quad 7.5" Sheet Woodward Island, scale 1: 24,000).

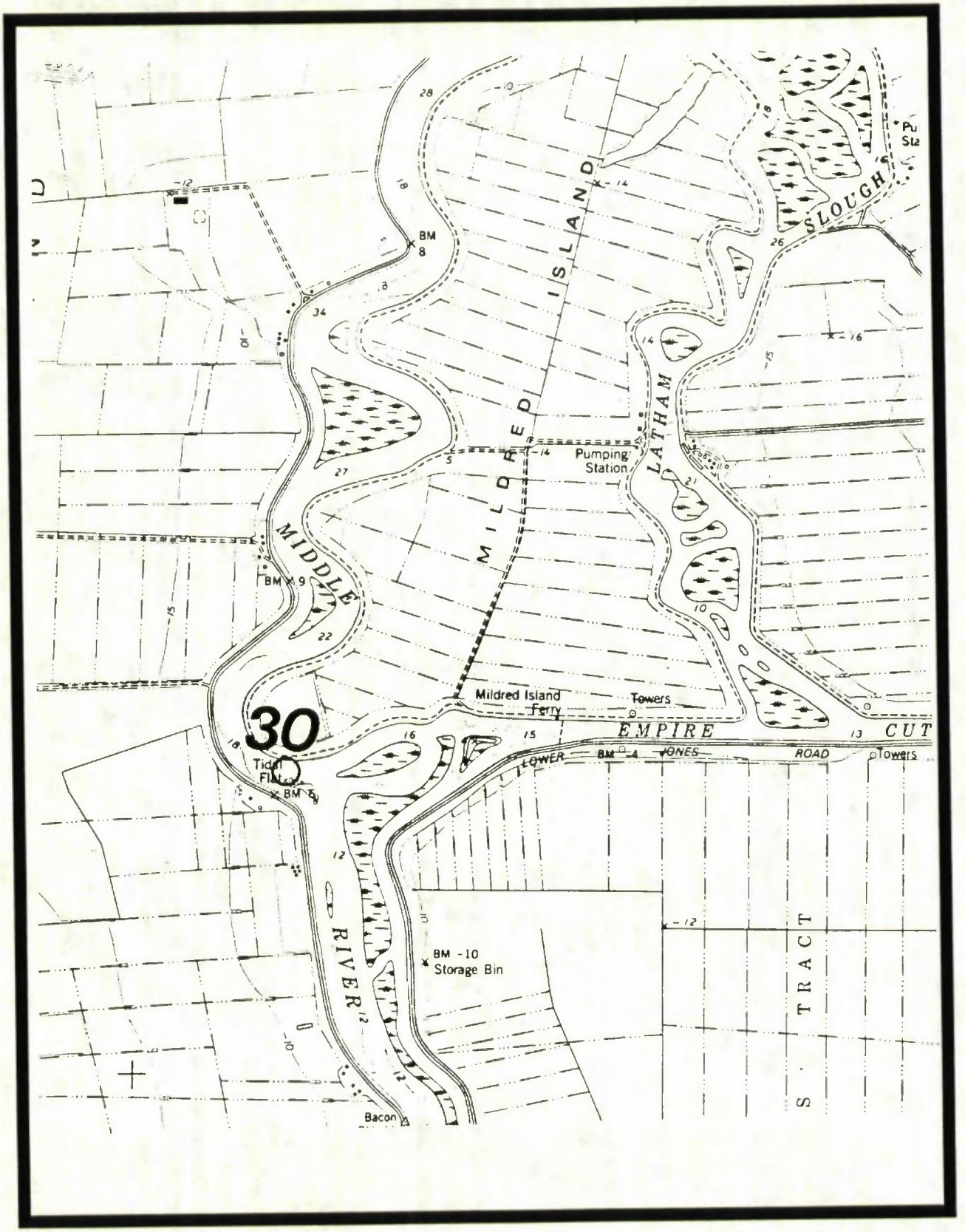


FIGURE 15. Location of CNDDB Occurrence 30. (Source: USGS Quad 7.5" Sheet Woodward Island, scale 1: 24,000).

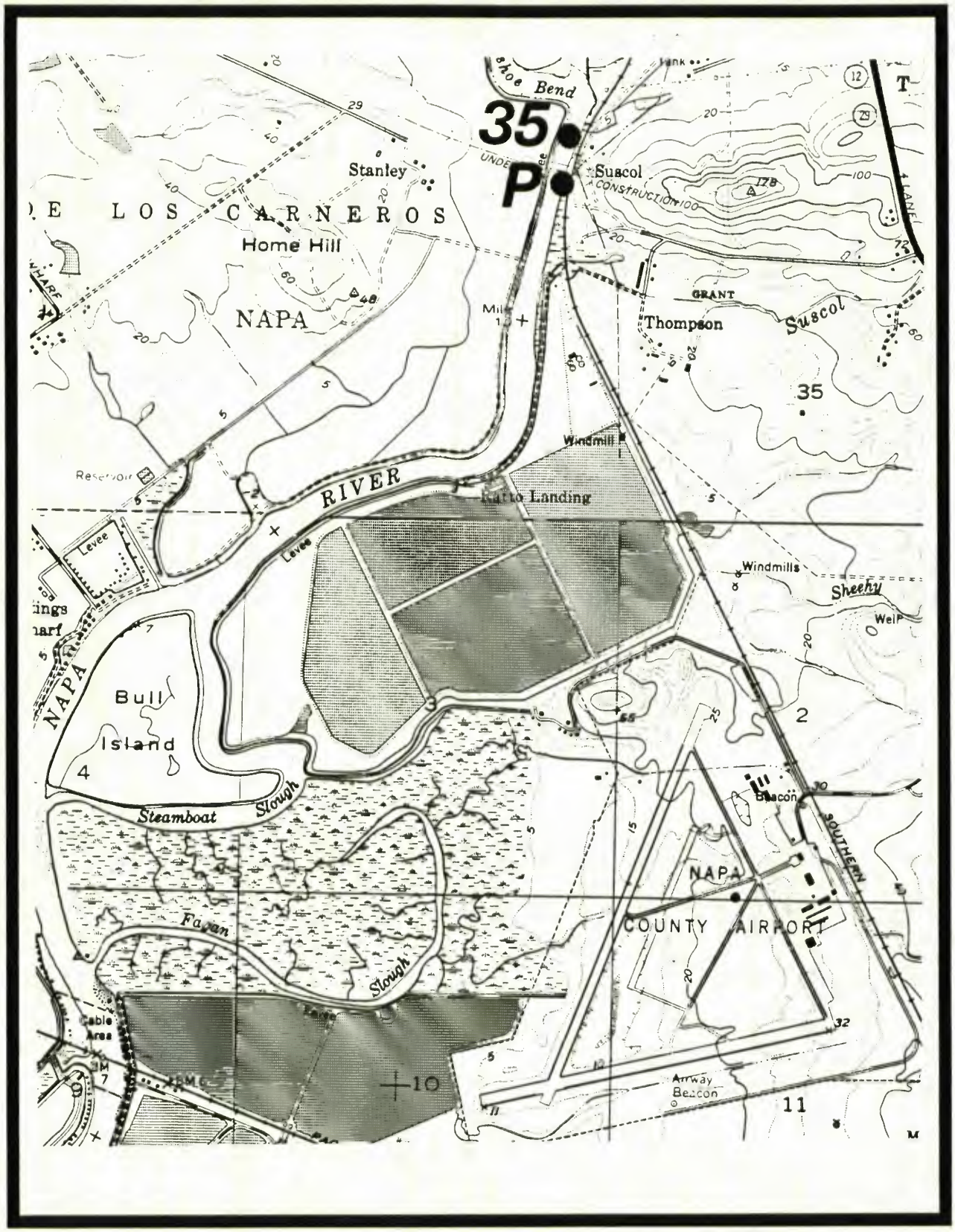


FIGURE 16. Location of CNDDB Occurrence 35 and new Occurrence P. (Source: USGS Quad 7.5" Sheet Cuttings Wharf, scale 1: 24,000).

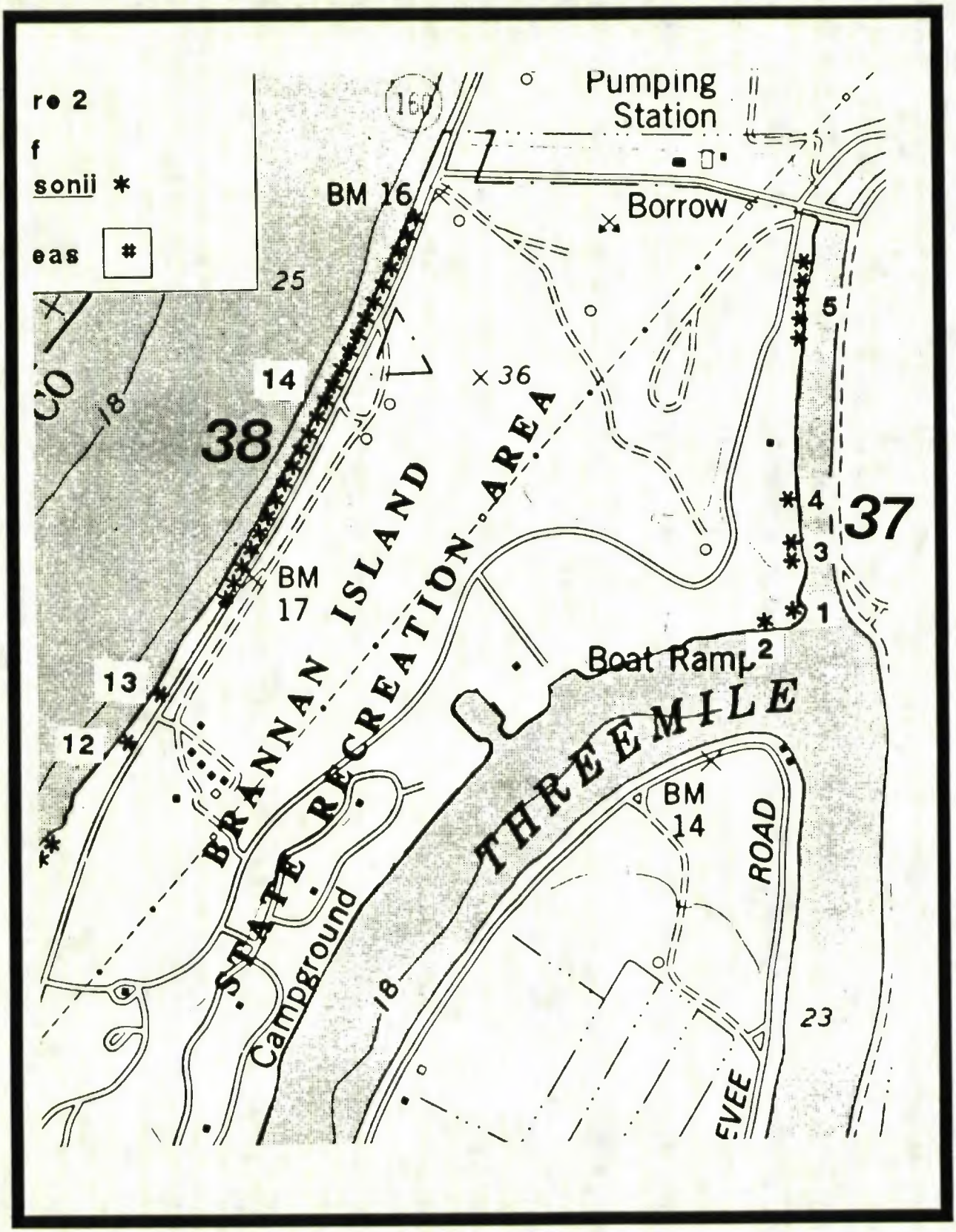


FIGURE 17. Location of CNDDB Occurrences 37 & 38. (Source: McCarten 1989).

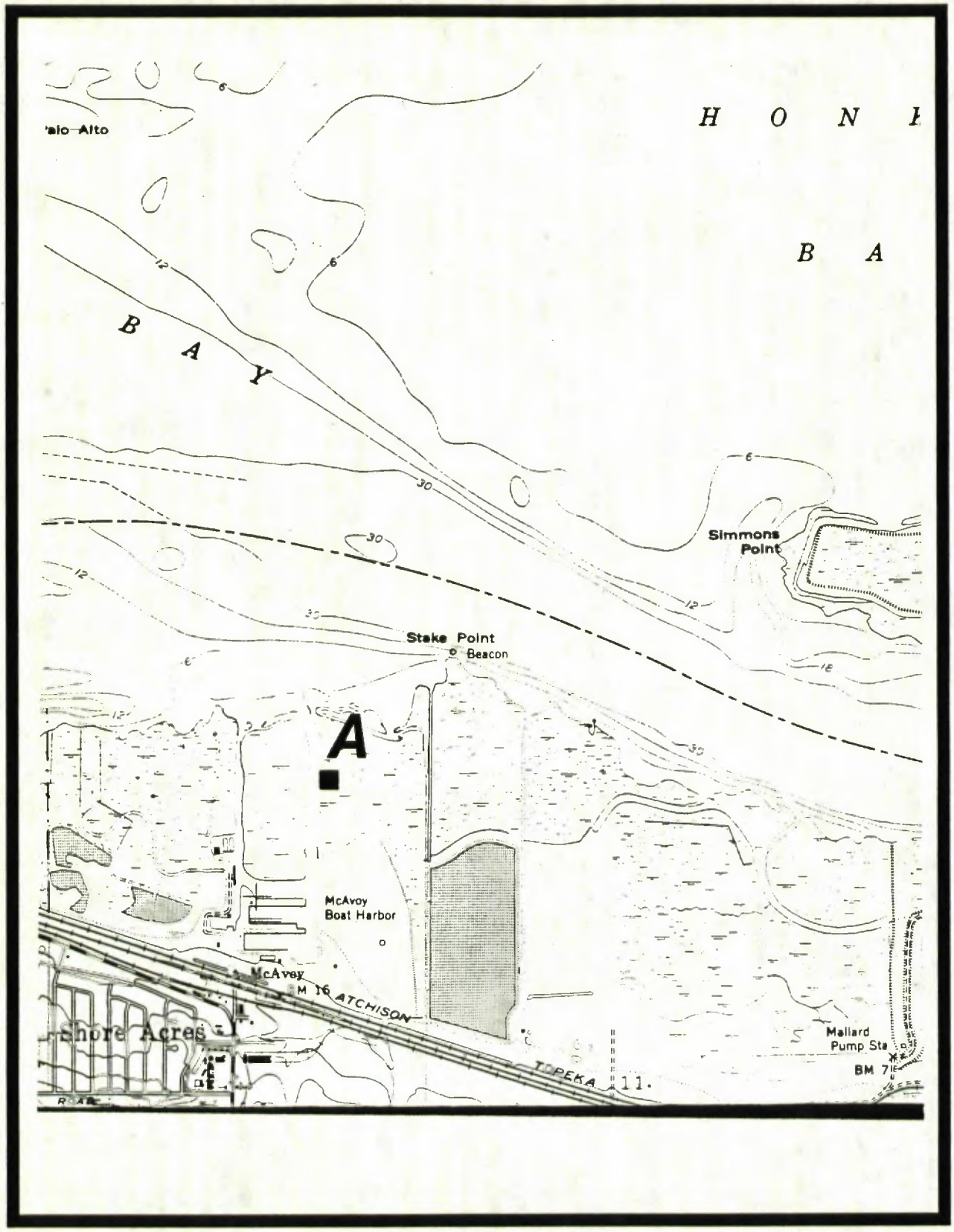


FIGURE 18. Location of new Occurrence A. (Source: USGS Quad 7.5" Sheet Honker Bay, scale 1: 24,000).

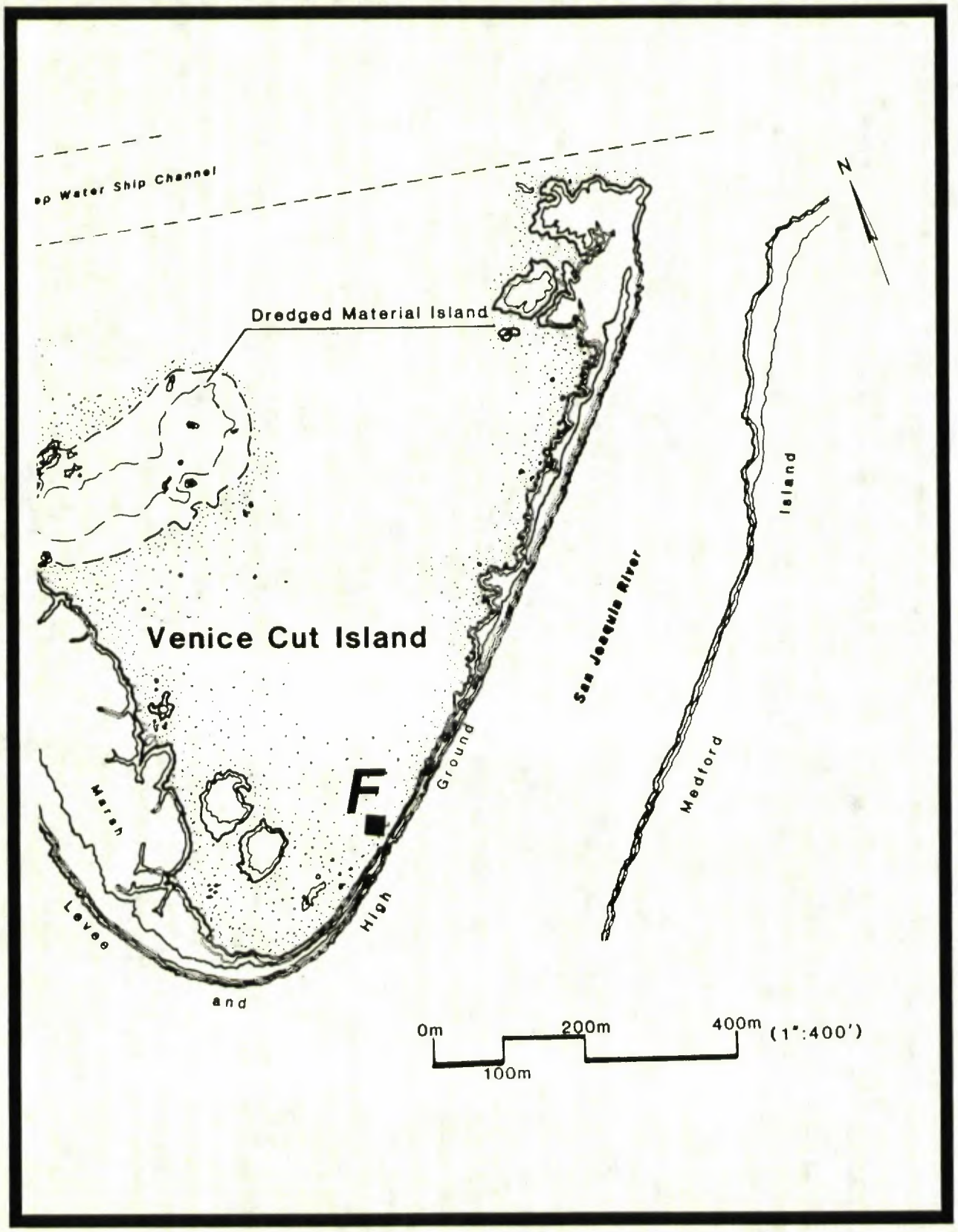


FIGURE 19. Location of new Occurrence F. (Source: England *et al.*, 1990, Scale 1":400').

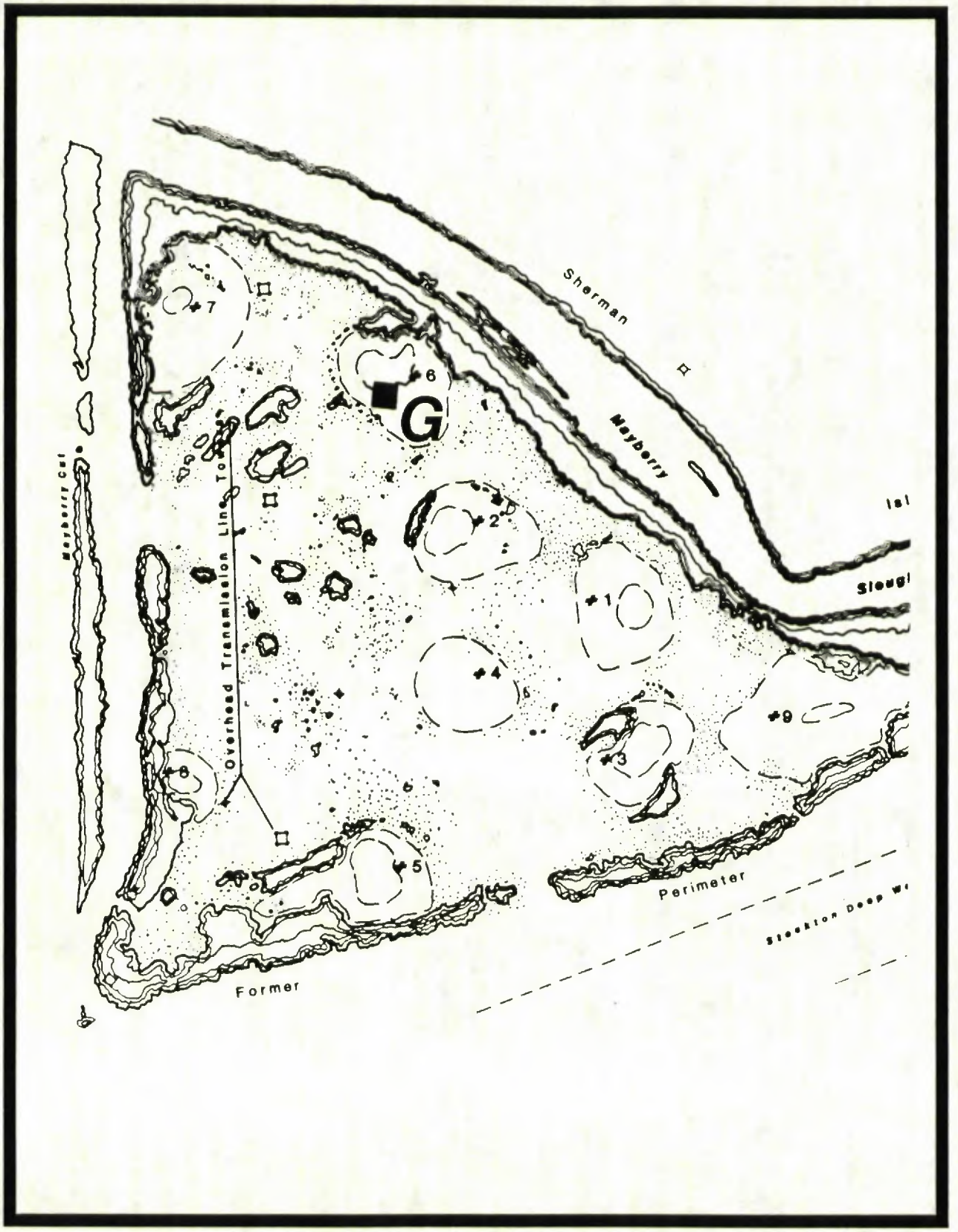


FIGURE 20. Location of new Occurrence G. (Source: England *et al.*, 1990; scale 1":400').

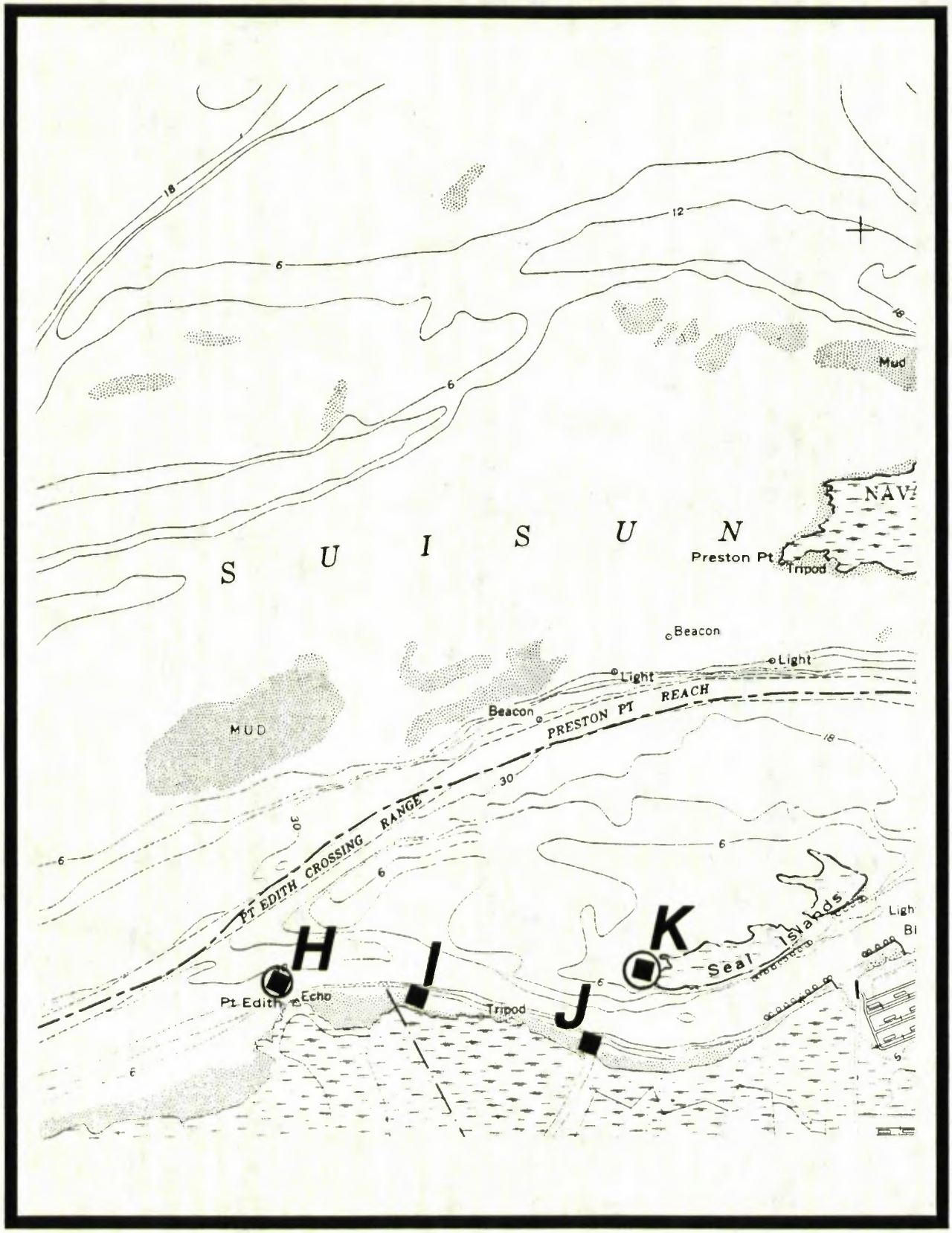


FIGURE 21. Location of new Occurrences H, I, J & K. (Source: USGS 7.5" Quad Vine Hill, scale 1:24,000).

APPENDIX B: COLOR PLATES

PLATE 1 (Above): General habit of *Lilaeopsis masonii*.
PLATE 2 (Below): Clonal growth of *Lilaeopsis masonii*, as illustrated by the vegetative spread at a sandy beach along the Sacramento River near the town of Rio Vista.

PLATE 3 (Above): *Lilaeopsis masonii* growing on old pilings at the Imola St. Bridge, Napa, California.
PLATE 4 (Below): *Lilaeopsis masonii* growing amongst *Hydrocotyle verticillata* var. *triradiata.*

PLATE 5 (Above): *Lilaeopsis masonii* growing amongst the rhizomes of *Scirpus californicus*.
PLATE 6 (Below): *Lilaeopsis masonii* growing on a substrate with high organic matter content.

PLATE 7 (Above): *Lilaeopsis masonii* growing on a predominately silt substrate.
PLATE 8 (Below): *Lilaeopsis masonii* growing on a predominately sandy substrate.

PLATE 9 (Above): *Lilaeopsis masonii* growing on old pilings.
PLATE 10 (Below): *Lilaeopsis masonii* at the Antioch Dunes National Wildlife Refuge (CNDDB Occ #1), growing on an old, beached barge.

PLATE 11 (Above): *Lilaeopsis masonii* population at CNDDB Occ #5, along the northwest/west side of Montezuma Island.
PLATE 12 (Below): *Lilaeopsis masonii* population at the base of the old Antioch Bridge, north bank of the San Joaquin River.

PLATE 13 (Above): *Lilaeopsis masonii* growing under *Alnus rhombifolia* on an islet west of Donlon Island.
PLATE 14 (Below): *Lilaeopsis masonii* on sandy beach along the Sacramento River near the town of Rio Vista.

PLATE 15 (Above): *Lilaeopsis masonii* population growing in riprap at the confluence of the Contra Costa Canal and New York Slough.
PLATE 16 (Below): *Lilaeopsis masonii* population at Suscol Creek confluence with the Napa River.

PLATE 17 (Above): *Lilaeopsis masonii* growing on rotting piling 100 meters south of the Third Street Bridge over the Napa River, city of Napa.

APPENDIX C:
LIST OF ASSOCIATED PLANTS

APPENDIX C:
LIST OF ASSOCIATED PLANTS

Agrostis alba
Agrostis exarata
Agrostis semiverticillata
Alisma plantago-aquatica ssp. *brevipes*
Alnus rhombifolia
Ambrosia psilostachya
Apium graveolens
Artemisia douglasiana
Arundo donax
Aster chilensis var. *lentus*
Atriplex patula var. *hastata*
Baccharis douglasii
Baccharis pilularis ssp. *consanguinea*
Bidens laevis
Calamagrostis nutkaensis
Calystegia sepium
Centarium floribundum
Cephalanthus occidentalis
Cichorium intybus
Convolvulus arvense
Cornus stolonifera var. *californica*
Cortaderia selloana
Cotula coronopifolia
Crassula aquatica
Cuscuta salina
Cynodon dactylon
Cyperus eragrostis
Cyperus niger var. *capitatus*
Distichlis spicata
Eichornia crassipes
Eleocharis parvula(?)
Epilobium brevistylum
Epilobium paniculatum
Epilobium watsonii
Equisetum arvense
Eryngium articulatum
Foeniculum vulgare
Galium trifidum var. *subiflorum*
Gnaphalium purpureum
Grindelia humilis
Helenium bigelovii
Heliotropium currasavicum
Hydrocotyle verticillata var. *triradiata*
Hypericum anagalloides
Iris pseudacorus
Jaumea camosa
Juglans hindsii
Juncus articulatus
Juncus balticus
Juncus effusus var. *pacificus*
Juncus oxymeris
Juncus bufonius
Kickxia spuria
Lathyrus jepsonii
Lactuca seriola
Lepidium latifolia
Lolium perenne
Limosella subulata
Lippia nodiflora
Lotus corniculata
Lythrum californica
Medicago officinalis
Melilotus albus
Melilotus officinalis
Mentha arvensis
Mesembryanthemum crystallinum
Mimulus guttatus
Myriophyllum sp.
Paspalum dilatatum
Paspalum distichum
Phragmites communis var. *berlandieri*
Picris echioides
Plantago hirtella var. *galeottiana*
Plantago lanceolata
Plantago major
Poa annua
Polygonum persicaria
Polygonum monspeliensis
Potentilla pacifica
Quercus agrif olia
Robinia pseudoacacia
Rosa californica
Rubus procerus
Rumex conglomeratus
Rumex crispus
Sagittaria sanfordii
Salicornia virginiana
Salix goodingii
Samolus parviflorus
Scirpus americanus
Scirpus californicus
Scirpus cernuus var. *californicus*
Senecio hydrophilus
Setaria geniculata
Setaria verticillata
Solanum sp.
Sonchus asper
Sparganium sp.
Spergularia marina
Stachys albens
Tamarix sp.
Taraxacum officinale
Trifolium tridentatum
Triglochin maritima

Triglochin striata
Typha angustifolia
Typha latifolia
Ulmus campestris
Verbena bonariensis
Verbena hastata
Veronica anagallis-aquatica
Xanthium strumarium var. *canadense*

Appendix C

APPENDIX D: DATA SHEET

LILAEOPSIS MASONII SURVEY

Recorder(s)_____ Date_____

Location No._____ CNDDB Location No._____

Location Description:_____

_____

_____

_____

U.S.G.S. (7.5") Quad Sheet:_____

Voucher taken?: Yes No Collection No._____

Photo(s) taken?: Yes No Number(s): _____

Population Statistics

Length:_____ Width: _____

Vertical distribution _____ Horizontal distribution_____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation:_____

_____

_____

_____

Associated Near-Shore Vegetation:_____

_____

_____

_____

Environmental Data:

Low Tide:

H_20 Salinity:_____

H_20 Temperature:_____

H_2O Conductivity:_____

H_2O pH:_____

High Tide:

H_20 Salinity:_____

H_20 Temperature:_____

H_2O Conductivity:_____

H_2O pH:_____

Substrate: Mostly ... Silt Sand Clay Other

Comments:_____

_____

_____

_____

_____

APPENDIX E: COMPLETED DATA SHEETS

LILAEOPSIS MASONII SURVEY

12:50 p.m.

Recorder(s) MG, PLF

Date 28 June 90

Location No. 1

CNDDB Location No. # 1

Location Description: Antioch Dunes on old barge

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: (Yes) No — Collection No. # 516 -

Photo(s) taken?: (Yes) No — Number(s): 19-21 ? maybe 18

Population Statistics

Did not walk along shoreline - on

Length: ______ Width: ______

Vertical distribution ______ Horizontal distribution ______

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: ______ Distance covered ______

Vegetation

Associated Littoral Vegetation: Scirpus californicus ~~[illegible]~~ ~~? fastigiatus?~~, Algae, Agrostis longiligula, Juncus balticus,

Associated Near-Shore Vegetation: Scirpus californicus, Quercus Agri, Cortaderia, Plantago lanceolata, Lythrum Californica, Paspalum dilatatum, Aster chilensis v. lentus, Robinia ? pseudoacacia ?

Environmental Data:

Low Tide:		High Tide:	
H_2O Salinity:	1 ‰	H_2O Salinity:	
H_2O Temperature:	24.5 ° C	H_2O Temperature:	
H_2O Conductivity:	1150 umhos (1150	H_2O Conductivity:	
H_2O pH:	~~[illegible]~~ 6.0	H_2O pH:	

Comments: (1) substrate = rotting wood; on pilings - pop ½ ft × 1 ft 5" × 10"

(2) 6.5" × 4"

LILAEOPSIS MASONII SURVEY

Recorder(s): MG + PLF   Date: 26.VII.90 / 3:10 pm

Location No. 4   CNDDB Location No. 2

Location Description: Between Resort (Collinsville) + Marshall Cut, E. of Old Collinsville Resort

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No)   Collection No. ______

Photo(s) taken?: (Yes) No   Number(s): 36

Population Statistics

Length: See below   Width: ______

Vertical distribution ______   Horizontal distribution ______

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: ______   Distance covered ______

Vegetation

Associated Littoral Vegetation: Eryngium articulatum, S. californicus, J. balticus, Agrostis longifolia, Arundo donax, Salix ?laevigata, Eleocharis, Juncus xiphioides, Lythrum californicum, Lathyrus jepsonii, Helenium bigelovii, Rumex crispus

Associated Near-Shore Vegetation: Rosa californica, Salix, Arundo, Rubus, Calystegia sepium, comp. of yesterday, Cortaderia selloana, Aster chilensis v. lentus

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 2 ‰	H_2O Salinity:
H_2O Temperature: 29°	H_2O Temperature:
H_2O Conductivity: 4000 µmhos	H_2O Conductivity:
H_2O pH: 6.4	H_2O pH:

Substrate: Mostly ... Silt (Sand) Clay Other

Comments: Very scrawny-looking population - fragmented 2 m lt x 2 m wide in veg. between roots of S. californicus

Healthy pop seen on sunken barge just west of population

LILAEOPSIS MASONII SURVEY

Recorder(s) PLF + MG Date 26.VII.90

Location No. 2 CNDDB Location No. 3

Location Description: just west of mouth of Marshall Cut, E of Old Collinsville Resort. Growing @ margin of bank adjacent to 2 m of riprap.

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: (Yes) No Number(s): 34

Population Statistics

Length: approx 1-3 m Width: 300 m at min.

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Antioch North Distance covered

Vegetation

Associated Littoral Vegetation: Hydrocotyle, Plantago lanceolata, S. acutus v. californicus, Alnus, Typha angustifolia, J. balticus, Agrostis longiligula, Samolus parviflorus, Triglochin striata

Associated Near-Shore Vegetation: Alnus, Salix lasiolepis, Typha, Helenium, Grindelia humilis, Plantago lanceolata, Potentilla, Rumex ~~conglomeratus~~ crispus, S. californicus, Lythrum californicum, Paspalum dilatatum; Trifolium sp. Rosa californica Lathyrus jepsonii

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 2‰	H_2O Salinity:
H_2O Temperature: 25°C	H_2O Temperature:
H_2O Conductivity: 3000 μmhos	H_2O Conductivity:
H_2O pH: 6.3	H_2O pH:

Substrate: Mostly ... Silt Sand (Clay) Other Tom

Comments: Very dense vegetation - Perhaps threatened (possibly) by stabilization of bank by riprap → no wave action → vegetation grows + overtops L. masonii

L. masonii in flw. and fruit / Good looking (healthy) inds

LILAEOPSIS MASONII SURVEY

Recorder(s): ms PF Date: 26 July 1990

Location No. 3 CNDDB Location No. 4

Location Description: West side of Marshall Cut E. of Collinsville Resort

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: (Yes) No Number(s): 35

Population Statistics

Length: 18 meters Width: up to 5 meters

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: Hydrocotyl, Sc. Californicus, Juncus balticus Lythrum calif, Rumex crispus, Agrostis longiligula, Paspalum dilitatum Setaria sp, Equi š branches, Scirpus cirnuus, Helinium

Associated Near-Shore Vegetation: Calystegia sepium, Paspalum dilitatum, Rubus Cynodon, Lythrum calif. J. baltacus, Equisetum without branches ~~Staccoma~~ Fragmites, Sc calif, Salix sp

Environmental Data: ~~[illegible]~~ 2:50

Low Tide: **High Tide:**

H_2O Salinity: Same as East Side H_2O Salinity:

H_2O Temperature: H_2O Temperature:

H_2O Conductivity: H_2O Conductivity:

H_2O pH: H_2O pH:

Substrate: Mostly ... (Silt) (Sand) Clay Other — mostly silt

Comments: LM in flr - No Rip Rap - Healthy pop

LILAEOPSIS MASONII SURVEY

Recorder(s) mg / PF

Date 29 June 90 2:50 pm

Location No. (1)

CNDDB Location No. 5

Location Description: NW corner Montezuma Is

U.S.G.S. (7.5") Quad Sheet: Antioch No

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: (Yes) No Number(s): 16,

Population Statistics

Length: Width:

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: 1/17 leeward side agrostis, bulrush Distance covered

Vegetation stop/pk E

Associated Littoral

Vegetation: Calistegia, potentilla sp, Willow sp, Scirpus cernuus Helenium, Typhae, plantago (major), Lepidium, Agrostis longiligula Hypochaeris, Scirpus Californicus, Verbena sp? (pink flws) Rumex crispus, Lythrum californicum, Phragmites, Lepidium

(margin: same as)

Associated Near-Shore Vegetation: Rhubus, Polygonum hydropiperoides ~~[illegible]~~ Lathyrus jepsonii (Delta Tule pea)

Environmental Data:

(Low Tide:)	High Tide:
H_2O Salinity: 1 ½ ‰	H_2O Salinity: /
H_2O Temperature: 25	H_2O Temperature: /
H_2O Conductivity: 3100	H_2O Conductivity: /
H_2O pH: 6.3	H_2O pH: /

Comments: Water data: only meaningful @ high tide

Looks like Lima may be overgrown by assoc vegetation

LILAEOPSIS MASONII SURVEY

Recorder(s) MG / ED Date 12 July 1990

Location No. _____ CNDDB Location No. 6

Location Description: On Sandy banks / beach of Sacramento River just NE of Powerlines NE of Tolands Landing.

U.S.G.S. (7.5") Quad Sheet: Jersey Island

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: Yes (No) Number(s): _____

2 large pops 6^2 m ea and several smaller pops along a 100 m stretch

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Phragmites communis v. berlandieri, Hydrocotyl verticillata v. triradiata, Plantago sp, Mimulus guttatus, Scirpus californicus, Scirpus cernuus v. californicus, Aster chilensis v. lentus,

Associated Near-Shore Vegetation: Juglans hindsii, Helenium bigelovii, Lepidium latifolia, Salix sp., Melilotus officinalis, Verbena bonariensis, Ambrosia sp.

Environmental Data: 1:30 pm

Low Tide:	High Tide:
H_2O Salinity: 0 ‰	H_2O Salinity: _____
H_2O Temperature: 27°C	H_2O Temperature: _____
H_2O Conductivity: 500	H_2O Conductivity: _____
H_2O pH: 6.1	H_2O pH: _____

Substrate: Mostly ... (Silt) Sand (Clay) Other

Comments: Very thick in some spots of Hydrocotyl (like a carpet among the Phragmites - also growing under the Phragmites where bank is undercut (somewhat shady)

Note: Decker Island looks like it has many populations

LILAEOPSIS MASONII SURVEY

Recorder(s) mz / El — Date 12 July

Location No. 1 — CNDDB Location No. 7

Location Description: ~ 1/2 mile No. of the Southern Tip of Twitchel Island along 3mile Slough on banks of Sherman Island (Just So. of Brannon Is) ~ 1.25 South from ~~Marina~~ outfrisco MARINA on W. bank of Sherman Is Land rd at 3mile slough

U.S.G.S. (7.5") Quad Sheet: Jersey Is

Voucher taken?: Yes (No) — Collection No.

Photo(s) taken?: (Yes) (No) — Number(s): #22-24 on 25.VII.90 film

Population Statistics

Several ~~a~~ small pops ~ ~~2 ft x 1 ft~~ along a 50 yrd stretch

Length: — Width:

Vertical distribution — Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: — Distance covered

Vegetation

Associated Littoral Vegetation: Scirpus Calif, ~~Scirpus sp.~~?, Rubus, Lythrum lots of Limosella Juncus effusus v pacificus

Associated Near-Shore Vegetation: Salix Paspalum dilatatum Polygonum hydropiperoides, Verbena bonariensis Setaria geniculata (?)

Environmental Data: 12 noon (3mile Slough)

Low Tide:		High Tide:	
H_2O Salinity:	1‰	H_2O Salinity:	
H_2O Temperature:	28	H_2O Temperature:	
H_2O Conductivity:	550 µmhos	H_2O Conductivity:	
H_2O pH:	6.15	H_2O pH:	

Substrate: Mostly ... Silt Sand (Clay) Other 50 yards

Comments: Limosella mostly ~ ~~50~~ 4 ft x 3 ft
L. masonii only on mud amongst Rip Rap —
Several ~~2~~ v. small pops among the Limosella
Where enough mud collects among Rip Rap

\# Can access much by Road

Too much Rip Rap for any other populations

LILAEOPSIS MASONII SURVEY

Recorder(s) MG + PLF Date 25.VII.90

Location No. 5 CNDDB Location No. # 8

Location Description: just E. of Antioch Bridge - @ base of old bridge piling / structure
= Mathias + Constance's "Antioch Bridge" (?) 1984

U.S.G.S. (7.5") Quad Sheet: Jersey Island

Voucher taken?: Yes **No** (circled) Collection No.

Photo(s) taken?: **Yes** (circled) No Number(s): 19

Population Statistics

Length: 1.5' Width: 1.5'

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? **Yes** (circled) No

Number of stops: 7 - connecting to #4, 25.VII.90 Distance covered

Vegetation

Associated Littoral Vegetation: Senecio, Scirpus californicus, Rumex ~~sp~~ conglomeratus
Agrostis longiligula

Associated Near-Shore Vegetation: Salix sp, fennel, Helianthus, Helenium
Cyperus eragrostis

Environmental Data:

Low Tide:		**High Tide:**	
H_2O Salinity:	Same as	H_2O Salinity:	
H_2O Temperature:	25.VII.90 (4)	H_2O Temperature:	
H_2O Conductivity:	/	H_2O Conductivity:	
H_2O pH:		H_2O pH:	

Substrate: Mostly ... **Silt** (circled) Sand Clay **Other** (circled) amongst riprap

Comments: Robust individuals amongst riprap
Small pop

LILAEOPSIS MASONII SURVEY

Recorder(s) mg / PF Date 25.VII.90

Location No. 4 CNDDB Location No. 9

Location Description: 1/2 mile east of Antioch bridge on N shore - N end of Antioch bridge

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: (Yes) No Number(s): 13, 14

Population Statistics

Length: 1 m Width: .75 m

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: 7 Distance covered 100 yds.

Vegetation

Associated Littoral Vegetation: Scirpus californicus, Juncus oxymeris (?) = flattened stem, Agrostis longiligula, Polygonum hydropiperoides, Triglochin (6 carpels) Celery Spartina? Scirpus californicus

Associated Near-Shore Vegetation: Arundo donax, Celery, Tamarix? Solanum sp. Lactuca serriola

Environmental Data:

Low Tide:

H_2O Salinity: 0.25 ‰

H_2O Temperature: 27° C

H_2O Conductivity: 1000 µmhos

H_2O pH: 6.4

High Tide:

H_2O Salinity:

H_2O Temperature:

H_2O Conductivity:

H_2O pH:

Substrate: Mostly ... Silt Sand Clay (Other) Rip rap - on silt below.

Comments: Endangered - Rip Rap - occurring in Rip Rap where enough sediment accumulates Very small pop.

2nd pop 6×6" 30 ft to west. Aster divaricatus & Centella present @ stop

3rd 2'×2' 40 ft to west - intermittent - Pops very small + fragmented. Seems to grow @ base of A. longiligula

4th + 5th pops 5th = 2' × 8" - and E. globulus - @ Hydrocotyle + Triglochin on end of piling

6th - on two pilings just off shore go 100 yds E of bridge - ≈ A. longiligula

Larger - 7th - 2'×2' on shore 4 ft 50 yds E. of bridge - Scirpus cal., Senecio, [illegible], Spartina?

LILAEOPSIS MASONII SURVEY

Recorder(s) MG PF   Date 13 July 1990 / 1:45

Location No. 2   CNDDB Location No. 10

Location Description: on Pilings on W. bank of Napa River 1/4 mile down River from Imola Bridge [End of Private road (marina rd ?)]

U.S.G.S. (7.5") Quad Sheet: NAPA

Voucher taken?: Yes (No)   Collection No. ____

Photo(s) taken?: (Yes) No   Number(s): 8, 9, 10

Population Statistics

Length: ① .5' x .5' ② .75 x .75'   Width: ③ 2' x .5'   ③ .75 x .75

Vertical distribution ____   Horizontal distribution ____

Other stops along shoreline that confirm additional populations/ramets? Yes (No)

Number of stops: ____   Distance covered ____

Vegetation

Associated Littoral Vegetation: Atriplex patula v. hastata c̄ L.M out of piling – A
Scirpus ca, Carex sp, some umbel ?

Associated Near-Shore Vegetation: ~~Chicorium~~ * ice plant sp, polypogon monspeliensis, F. foeniculum vulg, convolvulus arvensis, Cichorium

Environmental Data:

Low Tide:		High Tide:	
H_2O Salinity:	10.5 ‰	H_2O Salinity:	
H_2O Temperature:	27°C	H_2O Temperature:	
H_2O Conductivity:	18000 umhos	H_2O Conductivity:	
H_2O pH:	5.7	H_2O pH:	

Substrate: Mostly ~~Peat~~ Silt Sand Clay Other

Comments: ~~two~~ 3 pops c̄ Top of Pilings & another pop on a fallen tree. Once pilings & log decay away – No more suitable substrate left – Rest is rip rapped. One more along wall of rip rap – Small + eaten

LILAEOPSIS MASONII SURVEY

Recorder(s): AG + RF Date: 27.VI.90

Location No.: — Didn't stop CNDDB Location No.: 13

Location Description: Islet of Dorlon Island
Growing under and amongst roots of overhanging alders

U.S.G.S. (7.5") Quad Sheet: Antioch North 3

Voucher taken?: Yes (No) Collection No.: _____

Photo(s) taken?: (Yes) No Number(s): _____

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: _____

Associated Near-Shore Vegetation: _____

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: _____	H_2O Salinity: _____
H_2O Temperature: _____	H_2O Temperature: _____
H_2O Conductivity: _____	H_2O Conductivity: _____
H_2O pH: _____	H_2O pH: _____

Comments: No data taken because it is treacherous to stop the boat there. Population appears robust + large

LILAEOPSIS MASONII SURVEY

Recorder(s) PLF, MG + EP Date 22.VI.90

Location No. 1 CNDDB Location No. 14

Location Description: San Joaquin mouth of Mayberry Cut on Sherman Island - approx. 50 m from confluence / 20 m North of TSI P6+E tower

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: (Yes) No Collection No. Holder + Holder #514 (3x)

Photo(s) taken?: (Yes) No Number(s): 1-3

Population Statistics

Length: (a) 0.5 m (b) 1 m Width: (a) 1.0 m (b) 2 m

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: unrecorded Distance covered The length of Sherman Island

Vegetation

Associated Littoral Vegetation: Scirpus Cernuus var californicus, Lasthenia parviflorus Triglochin striata, Hydrocotyl verticillata var. triradiata

Associated Near-Shore Vegetation: Rubus procerus, Salix ? lasiandra, Helenium bigelovii Scirpus californicus, Typha latifolia, Mimulus guttatus, Verbena bonariensis, Juncus oxymeris, J. effusus var pacificus, Physocarpus capitatus, Paspalum distichum Cyperus sp., Phragmites communis, Polygonum hydropiperoides, Eryngium aristulatum (ant.)

Environmental Data:

Low Tide: 10:20 a.m.

H_2O Salinity: 1‰ (refractometer ~0‰)

H_2O Temperature: 22°C

H_2O Conductivity: 1000 micromhos

H_2O pH: 5.7 (not raised, calibrated?)

High Tide:

H_2O Salinity: _____

H_2O Temperature: _____

H_2O Conductivity: _____

H_2O pH: _____

Substrate: Mostly ... Silt Sand (Clay) Other "Delta mud"

Comments: Some Lilaea initiating flowering

[AN-S Veg] Aster chilensis var lentus, Rumex crispus, R. conglomerata, Lythrum californicum, Agrostis exarata

LILAEOPSIS MASONII SURVEY

Recorder(s) RZ/mg Date 16 AUG 1990

Location No. _____ CNDDB Location No. 15

Location Description: All along NW → SW Chain Island

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: Yes (No) Number(s): _____

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Scirpus californicus, Scirpus cernuus v. californicus, Hydrocotyl verticillata var. triradiata, Atriplex patula v. hasta, plantago lanceolata, Convolvulus arvense, * Rumex crispis, Triglochin striata

Associated Near-Shore Vegetation: Artemisia Douglasiana, mentha arvensis, ~~Plantago~~ Lythrum californica, Phragmites communis var. berlandieri, Polygonum hyperpeperoides, Typha sp., Rubus procerus, Grindelia humilis, Cusenta sp., Gnaphalium purpureum, Cotula coronopifolia, Agrostis sp.

Environmental Data: 12:50pm

Low Tide:	High Tide:
H_2O Salinity: _____	H_2O Salinity: 1.5 ppt
H_2O Temperature: _____	H_2O Temperature: 23
H_2O Conductivity: _____	H_2O Conductivity: 3000
H_2O pH: _____	H_2O pH: 6.5

Substrate: Mostly ... Silt Sand (Clay) Other ~~Peat~~

Comments: * LM in flower *

many small pops along entire margin of Chain Island investigated (SW → NW side) Probably more around entire Island

LILAEOPSIS MASONII SURVEY

Recorder(s) RZ/MG Date 17 AUG 1990

Location No. (1) CNDDB Location No. 16/17

Location Description: All along the West end of Sherman Is (west of Sherman Lake) between Fimball Island and point Sacramento

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: Yes (No) Number(s): _____

Population Statistics many pops intermittent 1/2 m² – 3m²

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Rumex crispis, Hydrocotyl verticillata var. triradiata Scirpus californica, Scirpus cernuus var. californicus, Triglochin sp. Juncus balticus, Phragmities communis var. berlandieri, ~~Typh~~

Associated Near-Shore Vegetation: Lythrum californica, Aster chilensis var. lentus Artemisia Douglasiana, Rubus procerus, Stachys albens, Polygonum hyperpeperoides Eryngium articulatum, Rosa californica

Environmental Data: 11:40 am

Low Tide:	High Tide:
H_2O Salinity: 1 ‰	H_2O Salinity: _____
H_2O Temperature: 23° C	H_2O Temperature: _____
H_2O Conductivity: 2000 µmHOS	H_2O Conductivity: _____
H_2O pH: 6.1	H_2O pH: _____

Substrate: Mostly ... Silt Sand (Clay) Other ~~peat~~

Comments: On bank dominated by S. californica, Triglochon sp. Intermittent pops along the west end of Island

LILAEOPSIS MASONII SURVEY

Recorder(s) MG/PF Date 13 July 1990

Location No. (4) CNDDB Location No. 18

Location Description: Promontory @ Hill Sloughs on South side of Grizzly ~~Id~~ Island road near bridge

U.S.G.S. (7.5") Quad Sheet: Fairfield South

Voucher taken?: Yes (No) Collection No. ~~VS-17~~

Photo(s) taken?: (Yes) No Number(s): 15, 16, 17

Population Statistics

Length: 6' Width: 3'

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: 2 total Distance covered 150 m

Vegetation

Associated Littoral Vegetation: Triglochin striata, Atriplex patula v. hastata, Eleocharis, Distichlis spicata, Scirpus californica, Poantilla sp. Carex sp, Jaumea carnosa, Scirpus cernuus v. californica Juncus sp., Hydrocotyl verticillata v. triradiata

Associated Near-Shore Vegetation: Helminum bigelovii, Poantilla sp., Scirpus americanus, Melilotus (yellow 5-7), Agrostis longiligula, polypogon monospeliensis, Grindelia sp, Picris echioides, Rumex crispis, Hydrocotyl, Polygonum hydropiperoides, Typha angustifolia, Sonchus asper, Plantago sp., Apium graveolens

Environmental Data: 3:45 pm

Low Tide:	High Tide:
H_2O Salinity: 5‰	H_2O Salinity:
H_2O Temperature: 29°c	H_2O Temperature:
H_2O Conductivity: 8000	H_2O Conductivity:
H_2O pH: 6.1	H_2O pH:

Substrate: Mostly ... (Silt) Sand (Clay) Other peat

Comments: Very nice, but small pops Looks reasonably undisturbed NO OBVIOUS Threats

* Huge hydrocotyl leaves

Lots of wrack

- This area needs more investigation by boat

LILAEOPSIS MASONII SURVEY

Recorder(s) PLF + MG   Date 28.VI.90 2:00

Location No. 2   CNDDB Location No. 19

Location Description: Growing in riprap in PG+E (private) picnic area.
Growing amongst rocks!

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes No   Collection No. No

Photo(s) taken?: Yes No   Number(s): 0-3

Population Statistics

Length: 70"   Width: 32"

Vertical distribution ______   Horizontal distribution ______

Other stops along shoreline that confirm additional populations/ramets? Yes (circled) No

Number of stops: 2   Distance covered ______

west. end of picnic area on one piling
(small patch)

Vegetation Same because of riprap

Associated ~~Littoral~~ Vegetation: Aster chilensis v. lentus, Phragmites communis, Melilotus albus. Scirpus / californicus, Distichlis spicata; Juncus effusus or patens

Associated Near-Shore Vegetation:

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 0.5 °/oo	H_2O Salinity:
H_2O Temperature: 28 °C	H_2O Temperature:
H_2O Conductivity: 890 µmhos	H_2O Conductivity:
H_2O pH: 6.3	H_2O pH:

Comments: Local large clearing large population of Aster chilensis v. lentus; ~~[illegible]~~ tide never covers this population.

LILAEOPSIS MASONII SURVEY

Recorder(s) mg/RZ Date 18 AUG 1990

Location No. (1) CNDDB Location No. 21

Location Description: North west end of Browns Island, Suisun Bay

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: Yes (No) Number(s): _____

Largest population observed; 20 m^2
- many small pops (< 1 m^2) intermixed w Triglochin, S. cernu

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Scirpus californicus, Hydrocotyl verticillata v. triradiata, Triglochin sp., Juncus balticus, Scirpus cernuus var. californicus Phragmities communis v. berlandieri

Associated Near-Shore Vegetation: Calystegia sepium, Typha sp.

Environmental Data: ← 12 noon → in between tides

Low Tide:	High Tide:
H_2O Salinity: 2.5 ‰	H_2O Salinity: _____
H_2O Temperature: 22°C	H_2O Temperature: _____
H_2O Conductivity: 3400	H_2O Conductivity: _____
H_2O pH: meter wet - unable to measure	H_2O pH: _____

Substrate: Mostly ... Silt Sand (Clay) Other peat

Comments: Populations dominated by Triglochin - Appear to be Lilaeopsis masonii but are not. More of Island needs to be explored - Conditions dangerous; strong wave/current, sandy bar.

Limosella

LILAEOPSIS MASONII SURVEY

Recorder(s): PLF + MG   Date: 26 VII 90

Location No.: 1   CNDDB Location No.: 23

Location Description: Sandy beach 1.5 miles S of junct of Hwy 160 + Hwy 12 On west bank of Brannan Island - Beach is

U.S.G.S. (7.5") Quad Sheet: RIO VISTA

Voucher taken?: Yes ~~Yes No~~   Collection No. ~~[illegible]~~ PLF + MG #5 --

Photo(s) taken?: Yes (No)   Number(s): ~~[illegible]~~ 25 - ~~[illegible]~~ 32

Population Statistics (2) 10 m x 4 m (3) 4 x 3 m. (4) 6 x 3 m (5) isolated in 2x2 m patches along ~~[illegible]~~ over a 10 m strip.

Length: 2.5 m x 1 m; Width:

Vertical distribution   Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: Limosella subulata; Mimulus guttatus; Poa?; ~~Arundo donax~~, Scirpus americanus / californicus, S. californicus, Phragmites, Polygonum hydropiperoides, Aster chilensis v. lentus Juncus (oxymeris) ~~(flattened stem)~~; Cyperus eragrostis; Plantago lanceolata; ~~[illegible]~~ Cynodon dactylon [vs Digitaria?] J. balticus; Helenium bigelovii; Paspalum dilatatum

Associated Near-Shore Vegetation: Arundo donax; Rubus, Salix ?laevigata Distichlis spicata; Paspalum dilatatum, Verbena bonariensis; Cynodon; J. balticus, J. oxymeris ~~flattened stem~~; Salix sp - sibling? Tamarisk Equisetum / short branches

Environmental Data:

Low Tide:

H₂O Salinity: 0.0 ‰

H₂O Temperature: 25°C

H₂O Conductivity: 250 µmhos

H₂O pH: 6.5

High Tide:

H₂O Salinity:

H₂O Temperature:

H₂O Conductivity:

H₂O pH:

Substrate: Mostly ... (Silt) (Sand) Clay Other → Pure Sandy beach!

Comments: From Rio Vista bridge to Brannan Island Bridge - probably many undocumented locations

L. masonii in flower / fruit // Pops endangered by recreational use - trampling ~~[illegible]~~

LILAEOPSIS MASONII SURVEY

Recorder(s) MG / RZ Date 18 AUG 1990

Location No. 2 CNDDB Location No. 24

Location Description: on Southwest end of Winter Island

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: Yes (No) Number(s): _____

Population Statistics

Length: _____ Width: _____ many small pops along the banks $1m^2 - 3m^2$

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Phragmites communis var. berlandieri, Lepidium latifolia, Senecio hydrophilus, Scirpus californicus, Hydrocotyl verticillata var. triradiata Eryngium articulatum, Agrostis longiligula, Typha sp., Scirpus cernuus v. californicus, Juncus balticus

Associated Near-Shore Vegetation: Salix sp, Calystegia sepium, Aster chilensis v. lentus, Grindelia humilis

Environmental Data: ← 12 noon → in between tides

Low Tide:	High Tide:
H_2O Salinity: 1.4 ‰	H_2O Salinity: _____
H_2O Temperature: 22	H_2O Temperature: _____
H_2O Conductivity: 2480 umHOS	H_2O Conductivity: _____
H_2O pH: unable to record - battery wet	H_2O pH: _____

Substrate: Mostly ... Silt Sand (Clay) Other peat

Comments: _____

Limosella also

LILAEOPSIS MASONII SURVEY

Recorder(s) MS/RZ Date 20 AUG 1990

Location No. 2 CNDDB Location No. 27

Location Description: On Tule Island at Confluence of Miner Slough and Sacramento river deep water channel

U.S.G.S. (7.5") Quad Sheet: Rio Vista

Voucher taken?: Yes (No) Collection No. _____ many pops of 1000's of Individual

Photo(s) taken?: Yes (No) Number(s): _____

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Hydrocotyl verticillata v. triradiata, Scirpus californicus, Limosella subulata (in flower), Paspalum distichum, Crassula sp. Juncus oxymeris, Cyperus eragrostis, Eleocharis parvula, Hypericum anagalloides

Associated Near-Shore Vegetation: Epilobium watsonii, Verbena hasta, Polygonum hyperpeperoides, Lythrus californica, Salix sp, Alnus Rhombifolia, Rubus procerus, Cornus stolonifera v. californica

Environmental Data: ← 1:10 pm → In between tides

Low Tide:	High Tide:
H_2O Salinity: 0	H_2O Salinity: _____
H_2O Temperature: 24 C	H_2O Temperature: _____
H_2O Conductivity: 200	H_2O Conductivity: _____
H_2O pH: 6.0	H_2O pH: _____

Substrate: Mostly ... Silt Sand (Clay) Other Peat

Comments: * LM in flower *

LILAEOPSIS MASONII SURVEY

Recorder(s) mg/pf Date 25 July 1990

Location No. 1 CNDDB Location No. 31 a

Location Description: Just West of Canal spillway @ Antioch (Contra Costa canal spillway meets New York Slough)

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes No Collection No.

Photo(s) taken?: (Yes) No Number(s): 21, 22, 23

Population Statistics

Length: 216" Width: 360"

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered 75m

Vegetation

Associated Littoral Vegetation: Scirpus Californicus, Hydrocotyl verticellata v. triradiata, Scirpus cernuus v. californica, Juncus balticus, Triglochin striata, Eleocharis

Associated Near-Shore Vegetation: Convolvulus arvense, melilotus alba, Aster chilensis v. hartis Eryngium articulatum, Calystegia sepium, Phragmites communis v. berlandieri Heliotropium curassavicum, Distichlis spicata, Juglans hindsii, Rubus procerus, Lythrum californica, Lepidium latifolia, Typh angustifolia, Rumex crispis

Environmental Data: ← 10:25p → in between

Low Tide:	High Tide:
H_2O Salinity: 3.0	H_2O Salinity:
H_2O Temperature: 24	H_2O Temperature:
H_2O Conductivity: 5500	H_2O Conductivity:
H_2O pH: 5.8	H_2O pH:

Substrate: Mostly ... Silt Sand Clay Other

Comments: Several pops extending ~ 75 meters - Patchy distribution Extending up to Rip Rap *not found on any Riprap * Excellent site for Park

LILAEOPSIS MASONII SURVEY

Recorder(s) MG/PF Date 25 July 1990

Location No. 2 CNDDB Location No. 316

Location Description: Just east of CC Spillway on Piling; Major Siting @ Pt. east/north of Spillway Growing between old Rip Rap

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes No Collection No.

Photo(s) taken?: (Yes) No Number(s): 0,1

(4-5) Several small pops No longer than 12x12"

Population Statistics

Length: 20m Width: 20m Spottily distributed

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: Scirpus cernuus V. californica, S. californica, Juncus balticus, Plantago lanceolata, Poentilla pacifica

Associated Near-Shore Vegetation: Juncus balticus, Plantago lanceolata, Lepidium latifolia, Heleonium bigelovii, Agrostis exarata, Poentilla pacifica, Lythrus californica Cyperus eragrostis

Environmental Data: 11:30

Low Tide:	High Tide:
H_2O Salinity: 3‰	H_2O Salinity:
H_2O Temperature: 25°C	H_2O Temperature:
H_2O Conductivity: 5000	H_2O Conductivity:
H_2O pH: 6.5	H_2O pH:

Substrate: Mostly ... Silt Sand Clay Other Delta mud / Rippap

Comments: Pops growing on old riprap where silt/sand has accumulated - Growing throughout vertical distribution of Riprap
Pops look threatened by trampling - lots of broken glass
- Generally not looking good
- Not much destruction bet. nearshore & littoral zone

LILAEOPSIS MASONII SURVEY

Recorder(s) PLF + MG　　　Date 25 VII-90

Location No. 3　　　CNDDB Location No. 32

Location Description: Just west end @ Antioch pt.

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No)　　Collection No.

Photo(s) taken?: (Yes) No　　Number(s): 2

Population Statistics

Length: 3 ft　　Width: 3 ft

Vertical distribution　　Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops:　　Distance covered

Vegetation

Associated Littoral Vegetation: Samolus parviflora, Scirpus californicus, J. effusus v pacificus, J. balticus, Plantago lanceolata, Hydrocotyl, Agrostis longiligula, Helenium, Aster chilensis v. lentus, Lepidium latifolium, Lythrum

Associated Near-Shore Vegetation: Salix ?laevigata?, Rubus, Helenium bigelovii, Scirpus californicus, Verbena bonariensis, Calystegia sepium, Typha, Polygonum hydropiperoides, Alnus, Aster, Helianthus? albus?, Lepidium, Lythrum

Environmental Data:

Low Tide:	High Tide:
H_20 Salinity: 1.5 ‰	H_20 Salinity:
H_20 Temperature: 24°	H_20 Temperature:
H_2O Conductivity: 2500 µmhos	H_2O Conductivity:
H_2O pH: 6.2	H_2O pH:

Substrate: Mostly ... Silt Sand (Clay) Other

Comments: growing above riprap in remaining bank. Appears threatened by recreational use - fishing. Possibly portions extirpated to riprapping L. masonii found

Looks like reasonably new riprap!

Very endangered - Recommend survey for pops on islands off to w. of Antioch Pt.

Lathyrus jepsonii growing ~ 100 yds east of Antioch Pt - w Aster, L. masonii

LILAEOPSIS MASONII SURVEY

Recorder(s) MG, PLF Date 27.VI.90

Location No. 2 CNDDB Location No. 34

Location Description: S. end Dean Island

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: (Yes) No Number(s): 16, 17

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Hydrocotyl, Helenium bigelovii, Agrostis exarata, Salix ?laevigata, Lythrum californicum, Juncus ?balticus

Associated Near-Shore Vegetation: Rumex conglomeratus, Lythrum californicum, Agrostis exarata, Scirpus ~~californicus~~ californicus?, Rosa californica, Rubus? procerus, Aster chilensis v. lentus, Calystegia, Verbena, Trifolium striata

Environmental Data

Low Tide:	High Tide:
H_2O Salinity: 0.25 °/oo	H_2O Salinity: _____
H_2O Temperature: 24.5°C	H_2O Temperature: _____
H_2O Conductivity: 800 µmhos	H_2O Conductivity: _____
H_2O pH: 6.2	H_2O pH: _____

Comments: _____

Substrate = clay - "Delta Mud"

LILAEOPSIS MASONII SURVEY

Recorder(s) PF/MG Date 13 July 1990

Location No. (1) CNDDB Location No. 35

Location Description: West end of Suscol Creek - confluence with Napa River on East bank under bridge

U.S.G.S. (7.5") Quad Sheet: Cutting Wharf

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: (Yes) No Number(s): 1-4

Population Statistics

Length: 5'/7'/4' Width: 1'/1'/0.25'

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: (1) Distance covered 100 yrds

Vegetation

Associated Littoral Vegetation: Salicornia virginiana, Scirpus californica, Atriplex patula v. hastata, Eleocharis parvula, Juncus leseur?, Spergularia marina, Distichlis spicata, Triglochin sp.

Associated Near-Shore Vegetation: Grinelia sp, foeniculum vulgare, D. spicata, Lolium perenne, A. patula v. hasta, Lepidium latifolia, polygonum monospeliensis, Cotula coronopifolia, Kickxia spuria

Environmental Data: 12:05?

Low Tide:	High Tide:
H_2O Salinity: > 40% (?)	H_2O Salinity: _____
H_2O Temperature: 28°C	H_2O Temperature: _____
H_2O Conductivity: 21,000	H_2O Conductivity: _____
H_2O pH: 5.6	H_2O pH: _____

Substrate: Mostly ... Silt Sand Clay Other

Comments: Pop threatened by Recreational use - fishing, trampling, ORV, erosion

- not flowering or fruiting / Two small fragmented populations just north of confluence of Napa river and Suscol creek

LILAEOPSIS MASONII SURVEY

Recorder(s) AG + PW   Date 13.VII.90 / 2:30

Location No. 3   CNDDB Location No. 36

Location Description: 100 yds S. of third ST bridge over Napa River west bank found on old pilings

U.S.G.S. (7.5") Quad Sheet: Napa

Voucher taken?: Yes (No)   Collection No.

Photo(s) taken?: (Yes) No   Number(s): 10-14

Population Statistics

$\bar{x}$ Length: .75 $\bar{x}$ Width: .75

Vertical distribution   Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: ~~None~~ Melilotus alba, Atriplex patula v. hastata Carex sp. Scirpus californicus, Plantago sp., Polypogon monspeliensis Ulmus siberica (street tree) (Plantago major)

Associated Near-Shore Vegetation: ~~None Plantago~~ ~~[illegible]~~ Baccharis pilularis v. consanguinea, Foeniculum vulgare, Picris echioides, Polypogon monspeliensis, Poa pratensis (?) Plantago lanceolata, ~~[illegible] (?)~~, Agrostis alba

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 8.5 °/oo	H_2O Salinity:
H_2O Temperature: 28 °C	H_2O Temperature:
H_2O Conductivity: 15000 mhos	H_2O Conductivity:
H_2O pH: 5.7	H_2O pH:

Substrate: Mostly ... Silt Sand Clay (Other) - Pilings

Comments: Found growing on 7 pilings; also on 3 larger areas of muddy riprap about (2'x2')

Threatened by trampling, fishing + erosion of pilings

LILAEOPSIS MASONII SURVEY

Recorder(s) ML + DF Date 28.VI.93

Location No. 3B CNDDB Location No. 37 + 39

Location Description: Brannan Island State Recreation Area – East side of BISRA

U.S.G.S. (7.5") Quad Sheet: Jersey Island

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: (Yes) No Number(s): 8, 9

Population Statistics

Length: 50' Width: usually <1' / up to 10'

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: 2 total Distance covered _____

Vegetation

Associated Littoral Vegetation: Scirpus californicus, Polygonum hydropiperoides ~~Juncus oxymeris~~, ~~Juncus~~ ~~balticus~~, conglomeratus, Hydrocotyle verticillata v. triradiata, algae, Limosella subulata

Associated Near-Shore Vegetation: Juncus ? oxymeris, J. balticus, Cyperus eragrostoides? Rantza lanceolata, Paspalum dilatatum, Agrostis exarata, Helianium bigelovii, Verbena bonariensis, Juncus ? sp. Distichlis spicata

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 0.5 ‰	H_2O Salinity: _____
H_2O Temperature: 29° C	H_2O Temperature: _____
H_2O Conductivity: 450 μmhos	H_2O Conductivity: _____
H_2O pH: 7.7	H_2O pH: _____

Comments: pop grows at the north end of the swimming beach of BISRA → lower limit (extent) probably limited by trampling. Pop threatened by any recreational use.

Habitat - muddy sand

Limosella

LILAEOPSIS MASONII SURVEY

Recorder(s) MG + TF Date 28.6.90

Location No. 3C CNDDB Location No. 38

Location Description: Brannan Island State Rec Area - West Shore

U.S.G.S. (7.5") Quad Sheet: Jersey Island

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: (Yes) No Number(s):

Population Statistics

Length: Width: - See 4th Letter

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes (No)

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: Juncus oxymeris Limosella subulata, Scirpus ~~californicus~~ californicus ~~californicus~~ Cotula coronopifolia, Eleocharis Polygonum hydropiperoides Mimulus guttatus,

Associated Near-Shore Vegetation: Scirpus cernuus v. californicus, Scirpus ~~californicus~~ californicus ~~californicus~~, Rumex conglomeratus, Mimulus guttatus, Juncus oxymeris,

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 2.0/00	H_2O Salinity:
H_2O Temperature: 25.5°C	H_2O Temperature:
H_2O Conductivity: 300	H_2O Conductivity:
H_2O pH: 6.4	H_2O pH:

Comments: Very lush population; Limosella in bloom; rip rap between H.C & population

LILAEOPSIS MASONII SURVEY

Recorder(s) mg Date 8 AUG 1990

Location No. (1) CNDDB Location No. 39

Location Description: Along Hiway 160 at 1 mile South of Rio Vista Bridge on East Side of Sacramento River (just south of RV park)

U.S.G.S. (7.5") Quad Sheet: Rio Vista

Voucher taken?: Yes (No) Collection No. _____ pops vary in size from

Photo(s) taken?: Yes (No) Number(s): _____ $0.3m^2$ to $3m^2$

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: Scirpus californicus, Scirpus cernuus v. californicus, Juncus oxymeris, Mimulus guttatus, Aster chilensis var. lentus, Polygonum hyperpeproi Limosella subulata (in flower), Setaria verticillata,

Associated Near-Shore Vegetation: Verbena hasta, Lythrum californicum, Foeniculum vulgare, Equisetum sp., Chenopodium sp.

Environmental Data: 12:30pm

Low Tide:	High Tide:
H_2O Salinity: 0	H_2O Salinity:
H_2O Temperature: 27°C	H_2O Temperature:
H_2O Conductivity: 150	H_2O Conductivity:
H_2O pH: 6.1 **	H_2O pH:

Substrate: Mostly ... Silt (Sand) (Clay) Other peat

Comments: * LM in flower * Some very Dense populations Populations end where Riprap begins on North end and South end of beach ... clearly impacting populations. Many small pops extending along beach (behind minor riprap and old pilings) Some individual very robust with septa easily seen without hand lens. ** Where Riprap is covered with sand, populations spread out in reticulate fashion

LM in fruit and in flower

LILAEOPSIS MASONII SURVEY

Recorder(s) MG Date 22 June 90

Location No. 2 CNDDB Location No. New location

Location Description: E. side of Harris harbor 2 1/2 way between harbor and Suisun Bay. - Not common - Rhizomes - fragment s. ~~easily~~ easy - Brittle - some up on heavily grazed area bet. boat steps

U.S.G.S. (7.5") Quad Sheet: Honker Bay

Voucher taken?: (Yes) No Collection No. 515 ~~fied~~ fiedler + Golden (IX)

Population Statistics in flower

Vegetative Ramets 0 1-5 5-25 25-50 50-100 100-150 150-200 >200 Est._____

Reproductive Ramets 0 1-5 5-25 25-50 50-100 100-150 150-200 >200 Est._____

Seedlings Present? Yes No Est. No._____

Vegetation

Associated Littoral Vegetation: Distichlis spikata, Triglochum striata, Juncus bufonius, Scirpus (the little one), Juncus balticus? Cotula coronopifolia, Atriplex patula ssp hastata, Potentilla also, moss

Associated Near-Shore Vegetation: ~~Typ~~ Cotula, tule to tall - heavily grazed

threats - cattle grazing, bank erosion

Environmental Data:

Low Tide:	High Tide:
H_2O Salinity: 4.5‰	H_2O Salinity:
H_2O Temperature: 23 C	H_2O Temperature:
H_2O Conductivity: 7000 micro Mhos	H_2O Conductivity:
H_2O pH: 5.9	H_2O pH:

Substrate: clay - "Delta mud"

Comments: Cattle grazing up to pegulations

LILAEOPSIS MASONII SURVEY

Recorder(s) MG + RF Date 27.VI.90

Location No. 1 CNDDB Location No. None (New)

Location Description: West Island

U.S.G.S. (7.5") Quad Sheet: Antioch North

Voucher taken?: Yes (No) Collection No. ____

Photo(s) taken?: Yes No Number(s): ____

Population Statistics

Length: ____ Width: ____

Vertical distribution ____ Horizontal distribution ____

Other stops along shoreline that confirm additional populations/ramets? (Yes) No

Number of stops: 2 (total) Distance covered approx 1 Km.

Vegetation

Associated Littoral Vegetation: Hydrocotyle, Scirpus ~~?californicus~~ californicus, Eleocharis sp.

Associated Near-Shore Vegetation: Rosa californica, Phragmites communis, Scirpus ~~?californicus~~ californicus, Aster chilensis v. lentus, Cephalanthus occidentalis, Calystegia, Lythrum californica, Rumex conglomeratus; Paspalum dilatatum, Bromus, Juncus

Environmental Data: Agrostis ~~sp.~~ longiligula, Xanthium

Low Tide:	High Tide:
H_2O Salinity: ____	H_2O Salinity: ____
H_2O Temperature: ____	H_2O Temperature: ____
H_2O Conductivity: ____	H_2O Conductivity: ____
H_2O pH: ____	H_2O pH: ____

Comments: Population becomes more robust towards the western end of it - relatively large plants.

substrate - clay - "delta mud"

Limosella

LILAEOPSIS MASONII SURVEY

Recorder(s) MG + PLF   Date 28. VI. 90

Location No. 3A   CNDDB Location No. New

Location Description: Brannan Island State Recreation Area
(3A) Tower (PG+E) population

U.S.G.S. (7.5") Quad Sheet:

Voucher taken?: Yes (No)   Collection No. N/O

Photo(s) taken?: Yes No   Number(s): 4-8

Limosella IN BLOOM

71
37
71
21 3
2201

Population Statistics (3A)

Length: 31" x 71" = 2201"   Width: 180" to 272"

Vertical distribution   Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation * (3A) Tower

Rumex crispus

Associated Littoral Vegetation: Scirpus, Aster Chilensis var. - Agrostis lanilignle
Limosella subulata Helenium bigelovii, Verbena bonariensis, Mimulus gut.
Cyprus (eragrostoides ?) Juncus (oxymeris ?), Juncus (effusus/patens ?)
Polygonum (Hydropiperoides ?) (Agrostis/Poa ?) cyperus ?

Associated Near-Shore Vegetation: Equisetum sp. Arandodonax

Environmental Data:

Low Tide: (3A)   High Tide:

H_2O Salinity: 0 ‰ H_2O Salinity:

H_2O Temperature: 24° C H_2O Temperature:

H_2O Conductivity: 450 µmhos H_2O Conductivity:

H_2O pH: 6.2 H_2O pH:

(3A) **Comments:** * found growing amongst Limosella subulata, growing above rip rap zone

Stopped at McCarter #5 - verified small patches & that they are threatened by trampling

(over) Substrate - mostly sand

LILAEOPSIS MASONII SURVEY

Recorder(s) MS PF Date 29 June

Location No. 1a CNDDB Location No. none

Location Description: ~~S. Shore~~ Montezuma IS SW corner of point

U.S.G.S. (7.5") Quad Sheet: 14 No

Voucher taken?: Yes (No) Collection No. _____

Photo(s) taken?: (Yes) No Number(s): 17

Population Statistics

Length: 20 Width: 40

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral

Vegetation: _____

Associated Near-Shore Vegetation: _____

Environmental Data:

Low Tide:

H_2O Salinity: _____

H_2O Temperature: _____

H_2O Conductivity: _____

H_2O pH: _____

High Tide:

H_2O Salinity: _____

H_2O Temperature: _____

H_2O Conductivity: _____

H_2O pH: _____

Comments: _____

Limosella

LILAEOPSIS MASONII SURVEY

Recorder(s) mg PS Date 29 June

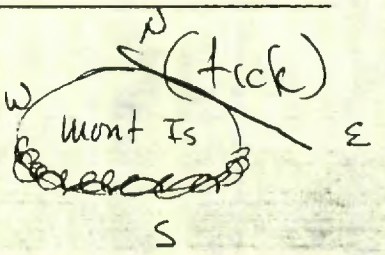
Location No. ~~the~~ 1b CNDDB Location No.

Location Description: ~~Sount~~ South Side Mont. Is ~ 1500 m E of point

U.S.G.S. (7.5") Quad Sheet: Photo # 19 for this sheet only

Voucher taken?: Yes No Collection No.

Photo(s) taken?: Yes No Number(s): 19, 20, 21, 22 (23)



Population Statistics

Length: 10 ft Width: 3 ft

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation Limosella on So. Side Island

Associated Littoral Vegetation:

Associated Near-Shore Vegetation:

Environmental Data:

Low Tide:

H_2O Salinity:

H_2O Temperature:

H_2O Conductivity:

H_2O pH:

High Tide:

H_2O Salinity:

H_2O Temperature:

H_2O Conductivity:

H_2O pH:

Comments:

LILAEOPSIS MASONII SURVEY

Recorder(s) MG / ED Date 12 July 1990

Location No. _____ CNDDB Location No. _____

Location Description: Dexter Island (inside Sloughs towards Sherman Island)

U.S.G.S. (7.5") Quad Sheet: _____

Voucher taken?: Yes No Collection No. _____

Photo(s) taken?: Yes No Number(s): _____

Population Statistics

Length: _____ Width: _____

Vertical distribution _____ Horizontal distribution _____

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: _____ Distance covered _____

Vegetation

Associated Littoral Vegetation: _____

Associated Near-Shore Vegetation: _____

Environmental Data:

Low Tide:	High Tide:
H_20 Salinity: _____	H_20 Salinity: _____
H_20 Temperature: _____	H_20 Temperature: _____
H_2O Conductivity: _____	H_2O Conductivity: _____
H_2O pH: _____	H_2O pH: _____

Substrate: Mostly ... Silt Sand Clay Other

Comments: looks like pops may be present – also pa. good site for transplants

LILAEOPSIS MASONII SURVEY

Recorder(s) PMF - MG　　Date 13 VIII 90 / 3:45

Location No. 4　　CNDDB Location No. ______

Location Description: Population @ 4 Slough on South side of Brannan Island

U.S.G.S. (7.5") Quad Sheet: ______

Voucher taken?: Yes (No)　　Collection No. 5-17

Photo(s) taken?: (Yes) No　　Number(s): ______

Population Statistics

Length: 6'　　Width: 3'

Vertical distribution ______　　Horizontal distribution ______

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: 2 total　　Distance covered 150 m

Vegetation

Associated Littoral Vegetation: Triglochin striata Atriplex patula, hastata Eleocharis Distichlis spicata Scirpus californicus, Potentilla Carex sp. Juncus Lycopus Scirpus californicus

Associated Near-Shore Vegetation: Helenium Potentilla Scirpus americanus, Rumex Hydrocotyle umbellata Nasa Melilotus Aster Grindelia Typha angustifolia Sonchus Plantago sp.

Environmental Data:

Low Tide:
H_2O Salinity: 5 ‰
H_2O Temperature: 29 °C
H_2O Conductivity: 8000 µmhos
H_2O pH: 6.1

High Tide:
H_2O Salinity: ______
H_2O Temperature: ______
H_2O Conductivity: ______
H_2O pH: ______

Substrate: Mostly ... (Silt) Sand (Clay) Other

Comments: Very nice but small population looks reasonably undisturbed. Reasonably healthy — no obvious threats. Hydrocotyle / Allium

accessed by land - maybe more pops - need boat

IN flower and fruit

LILAEOPSIS MASONII SURVEY

Recorder(s) MK Date 8 Aug

Location No. 2 CNDDB Location No. NEW pop

Location Description: Ryer Island - about 4 mile NE of Ryer Island ferry on Ryer Island Hwy 84 Road north Miner Slough where slough meets Sac deep River Channel

U.S.G.S. (7.5") Quad Sheet: Rio Vista

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: Yes (No) Number(s):

Population Statistics

Length: Width:

Vertical distribution Horizontal distribution

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation

Associated Littoral Vegetation: Hydrocotyl, polygonum hydro, Cyperus sp Scirpus sp, Juncus spp, Verbena bonar, Lythrum salicaria Taraxacum officinale, T. oxymeris, Samolus parviflorus Centorum floribundum, Cyperus era Lippia nodiflora

Associated Near-Shore Vegetation: Pospalum, Alnus sp, Rubus, Salix sp Rumex crispis, Lepidium, Foeniculum, Cornus stolonifera

Environmental Data: 3pm ←→

Low Tide:	High Tide:
H_2O Salinity: 8 ‰	H_2O Salinity:
H_2O Temperature: 28°C	H_2O Temperature:
H_2O Conductivity: 200	H_2O Conductivity:
H_2O pH: 6.8	H_2O pH:

Substrate: Mostly ... Silt Sand (Clay) Other

Comments: growing between exposed roots of Alnus sp - exposed at low tide - 3 such pops ~ 10 ft apart - probably more - no obvious threats

lots of Birds - almost like a mangrove - interesting place - need to explore further, by boat

** Note - populations observed No. of Rio Vista Bridge on Road to Ryer Is ferry on W. bank Sac.

info to Go on CNPS form

LILAEOPSIS MASONII SURVEY

Recorder(s) mg RKZ Date 17 Aug

Location No. 3 CNDDB Location No. New

Location Description: N of Donlon Island

U.S.G.S. (7.5") Quad Sheet: Antioc N

Voucher taken?: Yes (No) Collection No.

Photo(s) taken?: Yes (No) Number(s):

Population Statistics many populations along NE shore of donlon

Length: Width: Island ~ 400 yrds NW of powerline on little

Vertical distribution Horizontal distribution Island

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: Distance covered

Vegetation Scirp Ames Gnaphalium purpureum

Associated Littoral Vegetation: Helenium, Agrost exarata, Polyg. hydropiper

Scirp. calif, Aster sp, Rumex crisp, Calystegia, hydrocotyl

Apium, Triglochin maritima sp., Lythrum calif, J oxymeris, J balticus

Centaurium floribundum, Scirp cernuus

Associated Near-Shore Vegetation: Salix, Alnus rhombifolium

Environmental Data: 2:30

Low Tide:

H_2O Salinity:

H_2O Temperature:

H_2O Conductivity:

H_2O pH:

High Tide:

H_2O Salinity: 1 ppT

H_2O Temperature: 23

H_2O Conductivity: 1400

H_2O pH: 6.4

Substrate: Mostly ... Silt Sand (Clay) Other

Comments:

Rumex crispus

Triglochin

Scirpus cernuus var calif

Helenium

Clay

white polygon

ass:

Aster chil?

Salix, Alnus

Calystegia sepium

Scirpus calif

Juncus

Agrostis

Hydrocotyl

wild celery

Lythrus

Not in fruit
not in flower

NO flrs
NO fruit

LILAEOPSIS MASONII SURVEY

Recorder(s) MG/PP
Date 20 OCT 1990

Location No. 1
CNDDB Location No. New

Location Description: Venice Island see Survey form
Inner part of three mile reach (South side of tidal flat) at Venice cut between the Stockton Deep Water Channel and the Middle river of the San Joaquin river.

U.S.G.S. (7.5") Quad Sheet: Bouldin Is San Joaquin County

Voucher taken?: Yes No
Collection No. NO

Photo(s) taken?: Yes **No**
Number(s): NO

Threats: Hyacinth or whatever that plant is - also, ACOE put dredge spoils approx 1 km away - plants are establishing there but not LM - Slumping seems to be important for LM, and adding elevation may change the physical action of water, wind etc.

Population Statistics

Length: ______ Width: ______

Vertical distribution ______ Horizontal distribution ______

Other stops along shoreline that confirm additional populations/ramets? Yes No

Number of stops: ______ Distance covered ______

Vegetation

Associated Littoral Vegetation: Crassula sp (aquatica?) Juncus sp, Lilaeopsis, that floating weed starts w/ H.
THREAT → Eichornia crassipes establishing on both sides of pop

Associated Near-Shore Vegetation: Paspalum, Hydrocotyle
Rubus, Lythrum Californica, Scirp calif
unknown comps, Solanaceae sp, Cyperus sp.

Environmental Data:

Low Tide: 12:00 PM	High Tide:
H_2O Salinity: 0	H_2O Salinity:
H_2O Temperature: 19.0° C	H_2O Temperature:
H_2O Conductivity: 300 µmhos	H_2O Conductivity:
H_2O pH: 6.9	H_2O pH:

Substrate: Mostly ... Silt Sand Clay Other Peat - much organics in it
Histosol sapric

Comments:
Several thick but small pops
approx 1x2 ft + 3x3 + 1x2 ft.
"Slumping @ waters edge. seems to set
WIND WAVES and waves from Deep Water channel which about 1 mile away