

Revegetation and Monitoring Program
for
Moss Landing South Harbor
Restoration Project

Prepared for

The Moss Landing Harbor District
Mr. Craig Winter, Harbor Manager

Prepared by

The Habitat Restoration Group

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MOSS LANDING SOUTH HARBOR RESTORATION PROJECT

REVEGETATION AND MONITORING PROGRAM

INTRODUCTION

In June of 1988, the Moss Landing Harbor District regraded approximately 1.4 acres of jurisdictional wetland to create generally flat topography. In July of 1988, the U.S. Army Corps of Engineers (COE) informed the Harbor District that the grading was unauthorized because it had involved the filling of a jurisdictional wetland as defined under Section 404 of the Clean Water Act.

In a separate but related project, the District was required to mitigate for the loss of mudflat habitat as a result of a shoreline stabilization, or 'bulkhead', project on the west side of the South Harbor. Mitigation for both impacts took place at the filling site, located south of Sandholt Road, on the east bank.

The purpose of this revegetation project is to restore 1.4 acres of salt marsh, on a 1:1 mitigation basis, disturbed by the filling operation south of Sandholt Road.

The Moss Landing South Harbor Wetland Mitigation/Restoration Plan was prepared in February of 1989, by Jones & Stokes Associates, Inc., (Sacramento, California) and John Gilchrist & Associates (Santa Cruz, California). The Revegetation Implementation and Monitoring Plan was developed by The Habitat Restoration Group.

Prior to the implementation of the Jones & Stokes Restoration Plan, the mitigation site contained a deteriorated levee with a few native shrubs of *Spergularia macrotheca* (large-flower sand spurry), *Baccharis pilularis* ssp. *consanguinea* (coyote brush) and *Grindelia latifolia* (gum plant) scattered along the eastern face of the levee, intermixed with weedy, non-native vegetation.

The levee face laying directly adjacent to the Old Salinas River channel supported both low and high salt marsh vegetation of *Salicornia virginica* (pickleweed), *Frankenia grandifolia* (alkali heath) and *Jamea carnosa* (*fleshy jaumea*). Otherwise, most of the site was dominated by non-native grasses (*Avena* sp., *Bromus diandrus*) and forbs (*Raphanus* sp., *Brassica* sp.).

Colonies of *Distichlis spicata* (saltgrass) provided the greatest proportion of native cover on the site. A few patches of *Elymus* spp. were found in scattered populations throughout the mitigation site.

GOALS OF REVEGETATION

The goals of the Moss Landing South Harbor Restoration Project are to establish salt marsh and upland vegetation on the project site that is visually and ecologically similar to adjacent undisturbed areas; to begin a process of succession that will result in habitats and wildlife value similar to neighboring undisturbed salt marsh areas; and to return this area to a stable ecosystem which will require no further human input once vegetation has been re-established.

Plant Salvage Operation

The purpose of the salvage operation was to conserve species and genetic diversity of the plant life that was present at the project location prior to disturbance, to preserve soil microbial diversity (such as mycorrhizal fungi and decomposing organisms) that add to the fertility of the soil and increase the chances of a successful revegetation effort, to utilize existing native plants for replanting where commercially grown species are not available, to hasten the recovery and re-establishment of the salt marsh and upland ecosystems, and to commence planting before weed establishment, thereby minimizing future maintenance efforts.

Prior to the implementation of the salvage operation, a temporary nursery area was established at the dry storage area of the Moss Landing Harbor District. This area is located across Sandholdt Road, on the north side of the project site. Available plant materials were salvaged and transported to this temporary nursery site.

The nursery area was fenced off by driving stakes around the perimeter and using flagging tapes. This area received a topsoil layer of a few inches to facilitate a "heeling in" process of the root systems of salvaged plants. The root surfaces of salvaged plant materials were kept moist during the salvage and transportation. A simple hand-held hose and nozzle spray was used at the nursery to water the plants. During the grading operation and while the plants awaited installation, all salvaged and nursery-grown plant materials were maintained at the temporary nursery site.

Existing saltgrass and pickleweed marsh vegetation on the project site provided sufficient quantity of plant materials for replanting during the spring of 1990.

Potentially salvageable plant materials were identified on maps and in the field with the areas delineated by flagging. Debris was removed from the general vicinity of the salvageable plant areas. Large sod sections of salvageable plant materials were removed using a combination of manual labor and a small front-loader tractor. Individual salvageable plant materials were placed into one-gallon containers or grow-flats.

Propagules of plant materials which were not available for salvaging were collected in the spring of 1990, and are being grown by a local nursery (Sunset Coast Nursery). These propagules, other nursery-grown plants and seed of herbaceous groundcovers will be purchased and installed in the fall of 1990.

Topsoil Salvage and Application

Prior to the start of the grading operation, approximately 70 cubic yards of topsoil was salvaged from the area of the existing pickleweed marsh. This area was designated to be destroyed by the grading operation. Soil test samples obtained from this pickleweed marsh area had indicated good topsoil quality with high organic content, optimum pH values and a high level of available nitrogen.

The salvaged topsoil contained pickleweed propagules (seeds, cuttings and rooted plants) that will re-establish themselves and speed the process of revegetation within the pickleweed marsh area. This topsoil was transported to a stockpiling area within the dry storage facilities of the Moss Landing Harbor District. A front-loader tractor and a dump truck were used to excavate, transport and stockpile the topsoil.

After completion of the grading operation, eight plots, each with an average area of approximately 300 square feet, were established within the pickleweed marsh restoration area (between 4.5 and 6 feet elevation). The stockpiled topsoil was then transported back to the restoration site and placed near the plots with a front-loader tractor.

The topsoil was spread by hand within each plot to within four to six inches above the finished grade. After application, the topsoil was covered with jute netting and secured in place by driving 9-inch stakes around its periphery to provide erosion protection from tidal actions. Each plot received an average of nine cubic yards of salvaged topsoil.

Pickleweed Marsh Revegetation

(El. between 4.5-6.5 feet above MLLW) (Acreage = 1.42)

In addition to the eight topsoil application plots described above, the pickleweed marsh area was planted with *Salicornia virginica* (pickleweed), *Jumea carnosia* (fleshy jumea) and *Frankenia grandifolia* (alkali heath), obtained from the site in the salvage operation. Replanting took place immediately following the grading activities.

The pickleweed marsh area is expected to re-establish itself within a reasonably short time by natural colonization. Thus, revegetation of the pickleweed marsh area was limited to replanting with salvaged sod sections of salt marsh plant material at the upper limits of the restored pickleweed marsh (between five and six feet elevation). Approximately 150 square feet of existing pickleweed marsh was salvaged and replanted.

Prior to the installation of pickleweed marsh sections, planting locations were flagged. The salvaged pickleweed sod sections were cut into four-inch squares at the nursery site, transferred to grow flats and transported to the project site in the back of a pickup truck. A planting hole was excavated large enough to receive the marsh sections. Native soil backfill, with a slightly elevated berm constructed around the planting holes was used in installing the marsh sections.

Saltgrass Marsh Revegetation

(El. between 6.0-7.0 feet above MLLW) (Acreage = 0.24)

The saltgrass marsh area was planted in the spring of 1990 by using approximately 210 square feet of *Distichlis spicata* salvaged from the project site, along with associated species of *Grindelia stricta* ssp. *venulosa* (44 individuals in one-gallon containers) and *Elymus* spp. (45 individuals in one-gallon containers), which were salvaged from the mitigation site.

Sod sections of *Distichlis* and *Elymus* were cut into four-inch squares at the nursery site, transferred to grow flats and transported to the project site.

Prior to installation, planting locations were flagged by using a different colored flag for each species. Planting holes were excavated large enough to receive the sod sections of salvaged plant materials. Native soil backfill, with a slightly elevated berm constructed around the planting hole was used to install the sod sections.

To install the one-gallon container plants on sloping grounds, planting terraces 18 by 12 inches were constructed. The planting holes were excavated large enough to receive the root ball. Native soil backfill with a slightly elevated berm was constructed at the foot of the planting terrace. On level ground, berms were 30" in diameter and 3" inches high. The root crowns were set at 1" above grade to allow for settling.

Peripheral Upland Revegetation

(El. 7.0 feet or above MLLW) (Acreage = 0.64)

The peripheral and buffer zone area includes the upper end of the proposed salt marsh plain, the western face of the proposed levee, the top of the levee and the eastern slope of the levee.

The salvaged plant materials for designated peripheral upland areas were *Elymus* spp., *Atriplex patula* ssp. *hastata* and *Spergularia macrotheca* (large-flower sand spurry) .

Approximately 150 square feet of sod sections of *Elymus*, 32 flats of *Atriplex* and 32 flats of *Spergularia* were salvaged and transported to the temporary nursery location while awaiting completion of the grading operation. Other plant materials for the upland area were obtained from local native plant nurseries. Nursery grown plants were received in one-gallon containers.

After completion of the grading operation, salvaged sod sections were transferred to one-gallon containers and grow-flats at the nursery, before transportation to the project site for installation.

Elymus, *Atriplex* and *Spergularia* were cut into four-inch squares and transported to the project site in grow flats. Planting holes were excavated large enough to receive the sod sections of salvaged plant material. Backfill of native soil, with a slightly elevated berm constructed around the planting holes was used to install the sod sections.

To install the one-gallon container plants on sloping ground, a planting terrace, 18" by 12", was constructed. The planting holes were excavated large enough to receive the root balls. Backfill was native soil with a slightly elevated berm constructed at the front of the planting terrace. On level ground, berms were 30" in diameter and 3" high. The root crowns were set at 1" above grade to allow for settling.

IRRIGATION SYSTEM

Once the grading phase of the construction activities was completed and all equipment had been moved from the site, installation of the irrigation system began. A small tractor with a backhoe mount was used to trench approximately 300 feet of ground from the water meter to the northwest terminus of the project. This choice of trenching was due to the heavy compaction of the soil in the northern section of the site.

On top of the levee, for approximately 500 feet, a small self-propelled trencher was used to excavate a narrow trench to accommodate the one-inch PVC supply line. All PVC construction pipes were buried underground, while above surface connections were of galvanized steel construction.

An above-ground drip irrigation system was designed to allow for slow and even application of water to the soil. This will allow for the proper soil moisture to be maintained in the root zone over extended periods of time and provide optimum growing conditions for installed plants. The irrigation system shall remain in operation during the dry months (April to October) and shall be turned off during the rainy months, unless drought conditions prevail. Watering schedule will be twice a week, 5 gallons per week, per plant.

It is expected that the drip irrigation system shall be dismantled and removed from the restored site after three years, or when monitoring results indicate that plant establishment is progressing in a satisfactory manner.

The drip irrigation system consists of six circuits that are controlled by a fully automated 8-station, outdoor mount electric controller. Each circuit was designed to be independently controlled by two sets of three remote control valves. The first set of remote control valves was installed 300 feet from the north end terminus of the project site, on the eastern slope of the levee. The second set of control valves was installed approximately 320 feet south of the first set of controllers.

All sod section plants installed at the project site are watered by a 0-10 GPH bubble, set at 5 gallons-per-hour, while one-gallon container plants receive irrigation water via 1 gallon-per-hour emitters.

MAINTENANCE

The purpose of the maintenance program will be to identify problems needing remedial action (e.g., replanting, erosion control, or trash removal). It is likely that maintenance tasks will be conducted simultaneously with the monitoring task, so far as possible.

The following maintenance tasks will be performed during the maintenance visits:

1. Conduct routine maintenance and repair of the irrigation system to insure its proper operation.
2. Remove trash or debris that may hinder vegetation establishment and growth in any of the restored habitats.
3. Remove ice plant, German ivy and other weeds or competing vegetation that could reduce the quality of the restored habitat.
4. Replant shrubs or other plants to replace those that do not survive. Determine the reason for the loss of the plant, if possible, and use different plant materials or planting methods, if necessary.
5. Prepare an annual report to document results and findings of maintenance activities at the site and evaluate progress towards restoration goals.

All maintenance tasks will be performed once a month during the first year following the completion of the grading operation and the installation of the plant material. Thereafter, maintenance will be performed four times a year for a period of three years.

Coordination with the Moss Landing Harbor District will be conducted so that Harbor personnel will perform the necessary maintenance activities and weekly inspections of the restoration site to identify obvious or potential problems.

MONITORING PROGRAM

The goals of the monitoring program are to measure success of the restoration project, to evaluate the extent to which restoration of an entire ecosystem is established, to determine additional needs or inputs, such as replanting or control of undesirable plants, and to gather scientific information which will further our understanding of the processes of recolonization by the flora and fauna which usually inhabit salt marsh and mudflat habitats.

This restoration project provides a unique opportunity to establish parameters for future implementation of restoration/mitigation projects.

The lack of available data on restoration projects in this region is a further impetus for performing a well structured monitoring program that will generate useful information towards future planning for mitigation/restoration projects.

The Moss Landing South Harbor Restoration site has three basic habitats: the pickleweed marsh, the saltgrass marsh and the upland periphery. There are five areas of significance which require monitoring in the management of these habitats: (a) birds; (b) vegetation; (c) benthic infauna; (d) sedimentation; (e) elevation; and (f) soil. The general approach for monitoring these attributes is discussed below.

BIRD MONITORING

Monitoring bird use of the Moss Landing South Harbor Restoration Site will determine and document the value of the restored habitat as mitigation for impacts to wetlands and wildlife habitat.

Approach

Bird use of the Moss Landing South Harbor Mitigation Site will be monitored in every month of the year from August 1990 to September 1992. The monitoring program will include all of the restoration site, including the adjacent portion of the river channel out to 20 feet from the east bank of the Old Salinas River. Monitoring will focus on waterbird use of the site, as these bird species make the most significant use of the Old Salinas River. The monitoring program will record bird species richness, abundance, and activities during a variety of tidal conditions. The year-round sampling periods will provide information on use of the site by over-wintering, breeding, over-summering, and spring and fall migrant bird populations.

The monitoring program will include the following survey types:

Type 1: Standardized surveys of the restoration site and a control plot, conducted at semi-monthly intervals in the fall, winter and spring.

- Type 2:** Surveys of the restoration site, conducted year-round, approximately three to four times per month.
- Type 3** Mapping of bird use of the restoration site, denoting areas used for foraging and resting/roosting. Use patterns at the site will be mapped each time the site is surveyed.
- Type 4:** Breeding season surveys of the restoration site to document breeding by waterbirds and landbirds.
- Type 5:** A tally of the landbird species recorded on the restoration site.

Monitoring Protocol

All censuses will be performed using binoculars and a spotting scope, from a sufficient distance so as not to disturb birds using the sites. Censuses will not be performed during stormy conditions.

Survey Type 1. Sampling will occur in fall (August-September), winter (December, January), and spring (April, May). Each seasonal sampling period will include three surveys - one during high tide conditions and two during low tide conditions. Each survey will sample bird use of the restoration site and a control plot located immediately across the Old Salinas River. The control plot selected includes several small tidal creeks (sloughs), and is dominated by pickleweed marsh.

Each survey will occur from one hour before to one hour after the peak or ebb tide. The restoration site and control plot will be censused alternately, with each being censused five to six times per survey. Information recorded will include date, time, tide height, species present, and counts for each species. The counts of each species will be divided into those on land or in water, and those feeding or behaving otherwise.

Survey Type 1 will provide information on use of the restoration site relative to an adjacent, relatively high-value area of habitat, and will provide information on use of the site over a two hour period during each survey.

Survey Type 2. These surveys will be conducted at a variety of times and tide heights, and will not follow a standardized method with regard to the timing or number of surveys. Surveys will be conducted three to four times per month. Survey Type 2 will include a single census of the restoration site, and will not include a survey of the control plot. The information recorded on each census of the site will be the same as on Survey Type 1.

Information gathered on Survey Type 2 will augment that recorded on Type 1 by providing a more complete picture of seasonal variations in bird use of the site.

Survey Type 3. Survey Type 3 will include mapping the use areas of waterbirds observed on the site, and indicating whether birds were using an area for foraging or resting/roosting. Areas used by terns and pelicans will be specially noted so use of the site by these sensitive species can be analyzed separately.

Waterbird use of the site will be mapped at the end of each census conducted for Survey Types 1 and 2.

Survey Type 4. Careful surveys of the restoration site will be made in May and June to document any breeding by waterbirds or landbirds.

Survey Type 5. A running tally of landbird species observed on the restoration site will be maintained, including notes on any significant uses of the site.

Progress Reports and Final Report

Brief narrative reports will be prepared in March 1991 and 1992. These reports will summarize the results of the monitoring, discussing species richness, abundance and bird activities.

A detailed final report will be prepared following September 1992. This report will present all findings of the monitoring, comparing bird use of the restoration site over time, and comparing levels and types of use there to those of the control site. The success and value of the mitigation will be assessed.

VEGETATION MONITORING

Vegetation monitoring will be conducted on the restored area. Information on the plant species, percent cover and species diversity will be documented. Comparison will be made with a reference area established within an existing, undisturbed saltmarsh area.

Ten fixed transects will be established across the pickleweed and upland periphery plains (above elevations 3.5') as depicted on Figure #4. Each transect will be staked so that elevation changes are noted in each transect. Permanent one-meter square quadrats will then be established along the transect lines. A minimum of one quadrat per elevation of one foot will be established. Quadrat numbers in each transects will be set in the field during the first monitoring. Quadrats will be alternated from one side of the transects to the other.

Vegetation monitoring will occur during the months of March and September. Plant species cover will be determined within each quadrat and recorded to the nearest 10%. Plant species cover may exceed 100% within a quadrat. The average height of each species of plant within

each quadrat will be recorded to the nearest centimeter. One person should perform all the quadrat sampling within each transect, and the number of persons collecting data should be kept to a minimum.

Data from the vegetation sampling will be compared to a transect established in undisturbed saltmarsh and upland habitat, to be located across the Old Salinas River channel.

Qualitative observations will be made of natural and planted areas with every monitoring visit, noting the general characteristics of vegetated and unvegetated areas in each habitat.

Monitoring of the Revegetation Success

A success criteria of 90% survival after one full year of growth after installation shall be established for all installed plants.

The first measurement (September, 1990) will be to estimate survival rate of transplanted plant material and natural re-colonization. This will provide a measure of initial planting success, including for plant salvage and replanting methods.

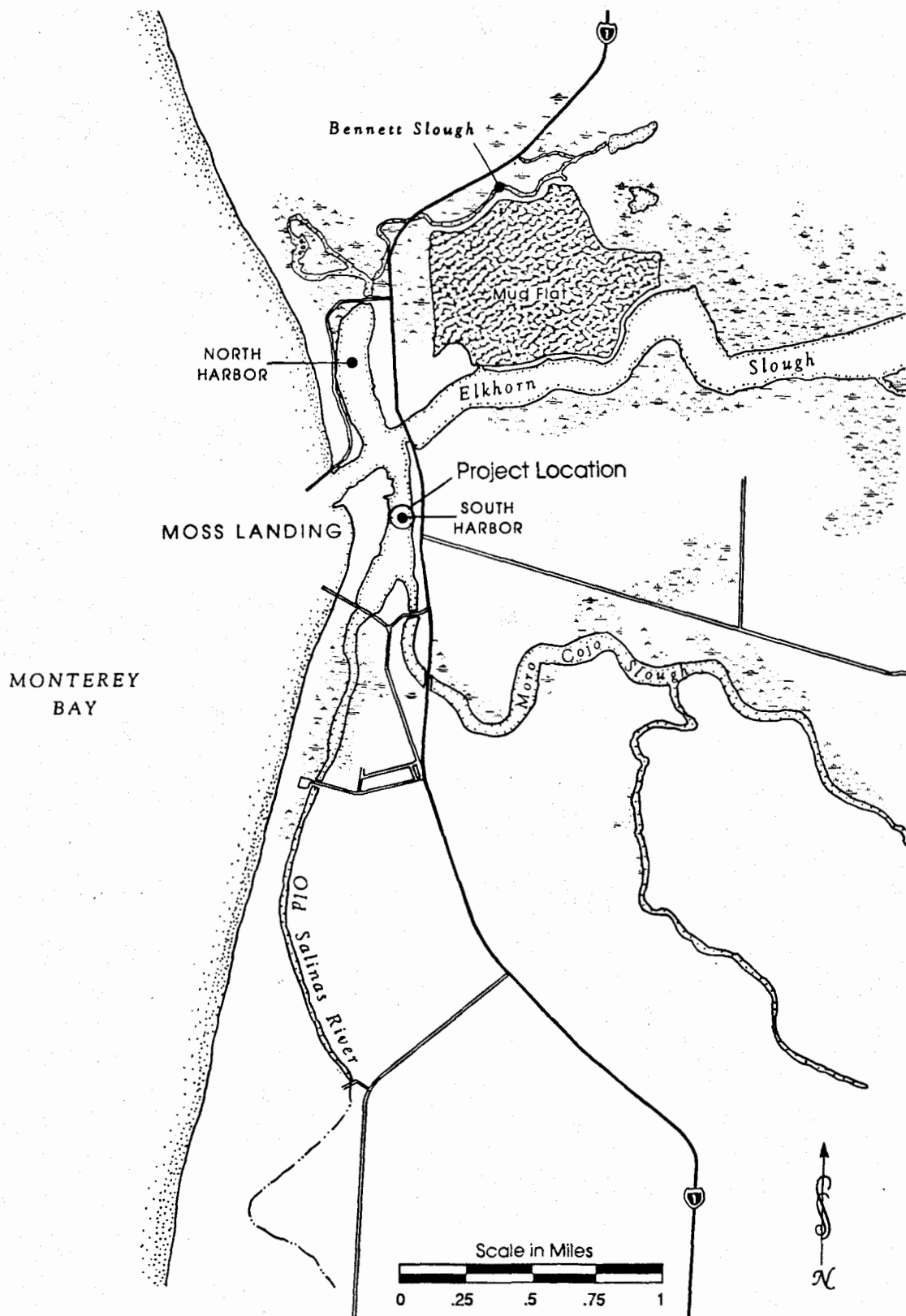
The results of this initial monitoring, which will take place at the end of the growing season (September), will be used to assess the success of the revegetation project. Parameters will include percent cover and recolonization rates.

Data will be summarized and listed by each transect and quadrat. The data will be analyzed using graphic techniques to show trends and to assess success of the revegetation/restoration project. Brief narrative reports will be prepared at the end of each monitoring year.

BENTHIC FAUNA MONITORING

Benthic fauna monitoring program is being developed for the Moss Landing South Harbor Restoration project in cooperation with the Elkhorn Slough Foundation, the Moss Landing Marine Laboratory and The Habitat Restoration Group. Mark Silberstein of the Elkhorn Slough Foundation, along with John Oliver of the Moss Landing Marine Laboratory, are in the process of selecting a graduate student to develop protocol and conduct the monitoring program.

This monitoring program will also encompass elevation, rates of deposition/sedimentation, erosion and soils chemistry.





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MOSS LANDING HARBOR
Project Location Map

Figure 1

PLANT LIST											
SYMBOL	SPECIES NAME	PLANT COMMUNITY TYPE								REMARKS	
		PICKLEWEED MARSH*			SALT GRASS MARSH*			PERIPHERAL UPLAND*			
		PROPAGULE TYPE	AMOUNT	PLANT SPACING	PROPAGULE TYPE	AMOUNT	PLANT SPACING	PROPAGULE TYPE	AMOUNT		PLANT SPACING
	<i>Frankenia grandifolia</i> <i>Jaumea carnosa</i> <i>Salicornia virginica</i>	4.5' x 4.5'	44	4'							Sod sections were distributed between the 5-6' elevation.
AP	<i>Atriplex patula</i> sp. <i>hastata</i>							4.5'x4.5'	32	5	
	<i>Distichlis spicata</i>										
E	<i>Elymus</i> spp.										
AB	<i>Achillea borealis</i> sp. <i>oerlicola</i>						69	4.5' x 4.5'	4'		Sod sections were distributed between the 6-7' elevation.
AC	<i>Artemisia californica</i>						15	4.5' x 4.5'	4		
AL	<i>Atriplex lentiformis breweri</i>										
BP	<i>Baccharis pilularis</i> sp. <i>consanguinea</i>										
EL	<i>Eriogonum latifolium</i>										Spacing to be determined in the field.
ES	<i>Eriophyllum staechadifolium</i>										
EC	<i>Eschscholzia californica</i> var. <i>maritima</i>										See planting plan for spacing.
GL	<i>Grindelia latifolia</i>										
HE	<i>Haplopappus ericoides</i>										See planting plan for spacing.
HB	<i>Hordeum brachyantherum</i>										
LA	<i>Lupinus arboreus</i>										
LC	<i>Lupinus charrissonis</i>										
SL	<i>Salix lasiolepis</i>										
SM	<i>Spergularia macrotheca</i>										Sod sections were distributed throughout the peripheral upland.

PICKLEWEED MARSH = 0.64 ACRE: SALT GRASS MARSH = 0.24 ACRE: PERIPHERAL UPLAND = 0.64 ACRE.
NOTE: ALL SODS APPROXIMATELY 4.5' X 4.5' SQUARE

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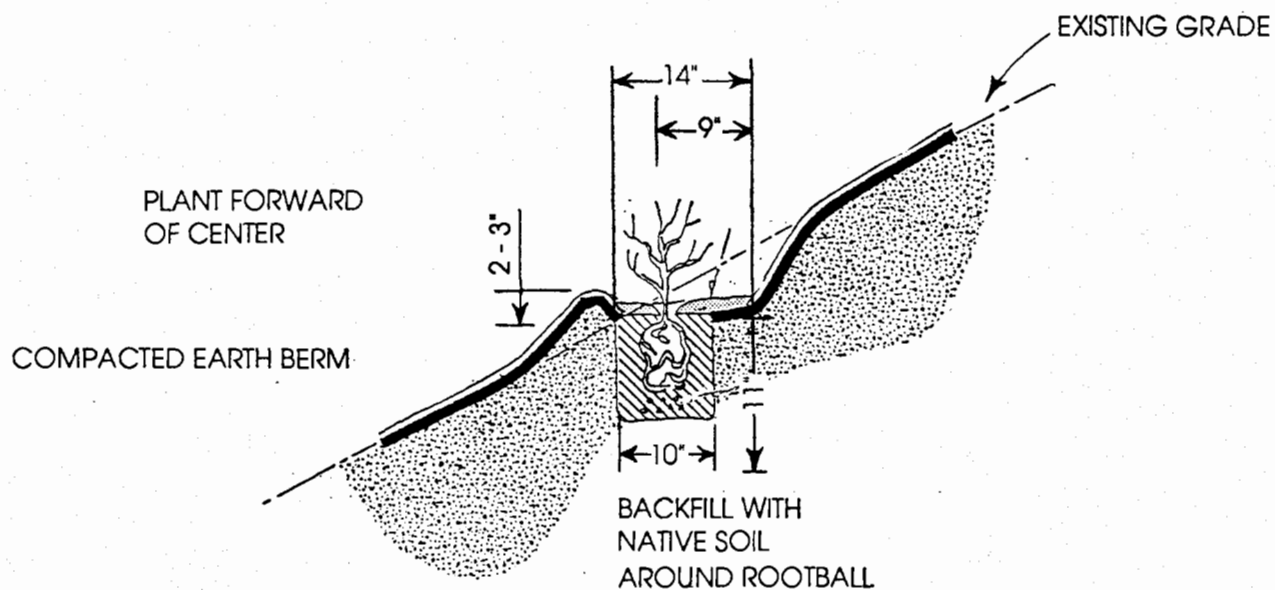
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MOSS LANDING HARBOR
Plant List

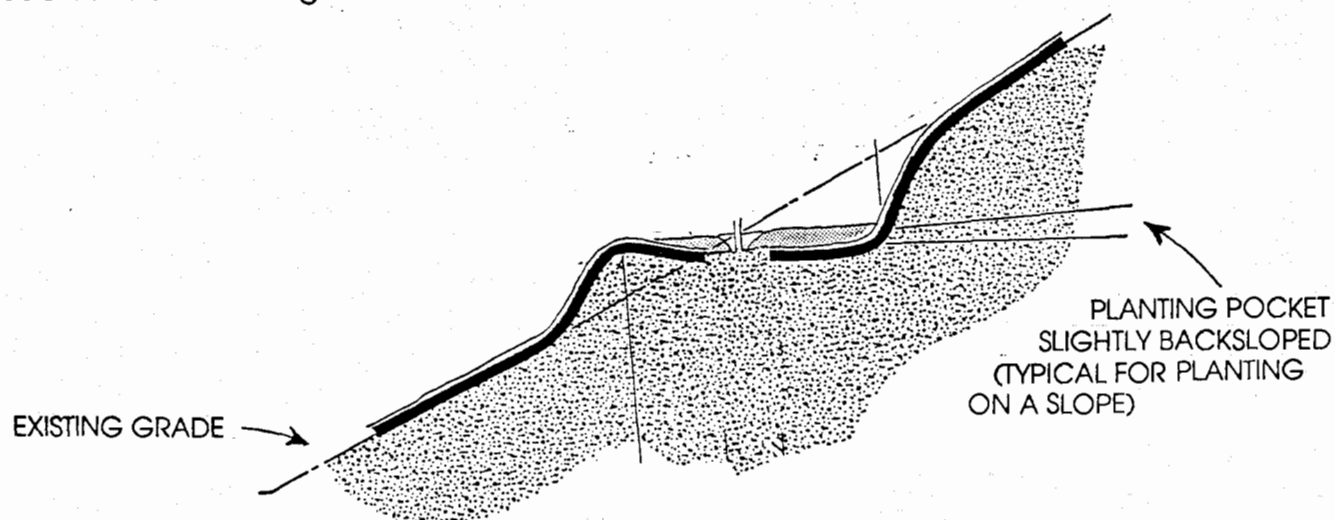
Figure 2

PLANTING ON SLOPE

Liner Planting & One Gallon Stock



Sod Section Planting



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MOSS LANDING HARBOR
Planting Details

Figure 3

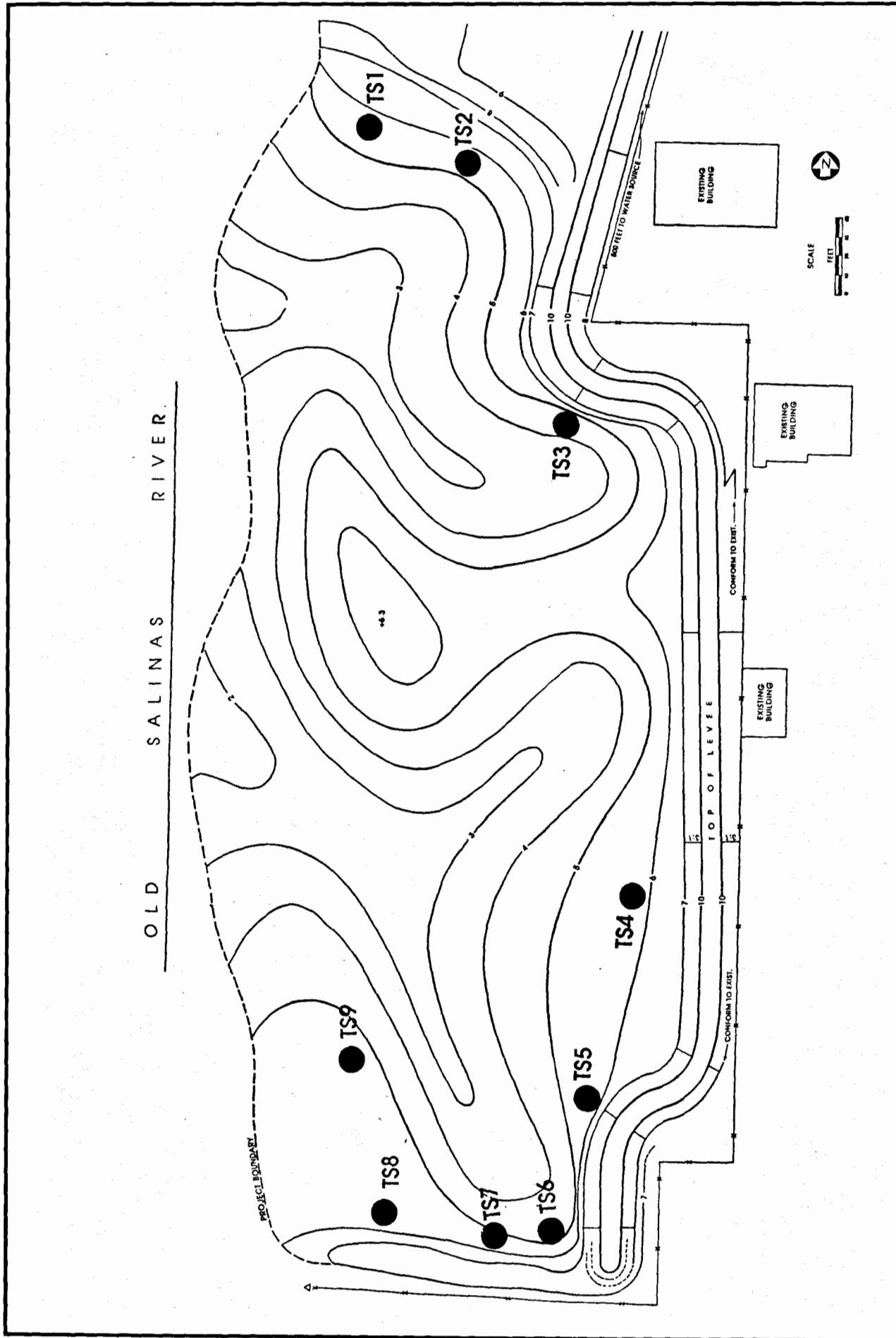


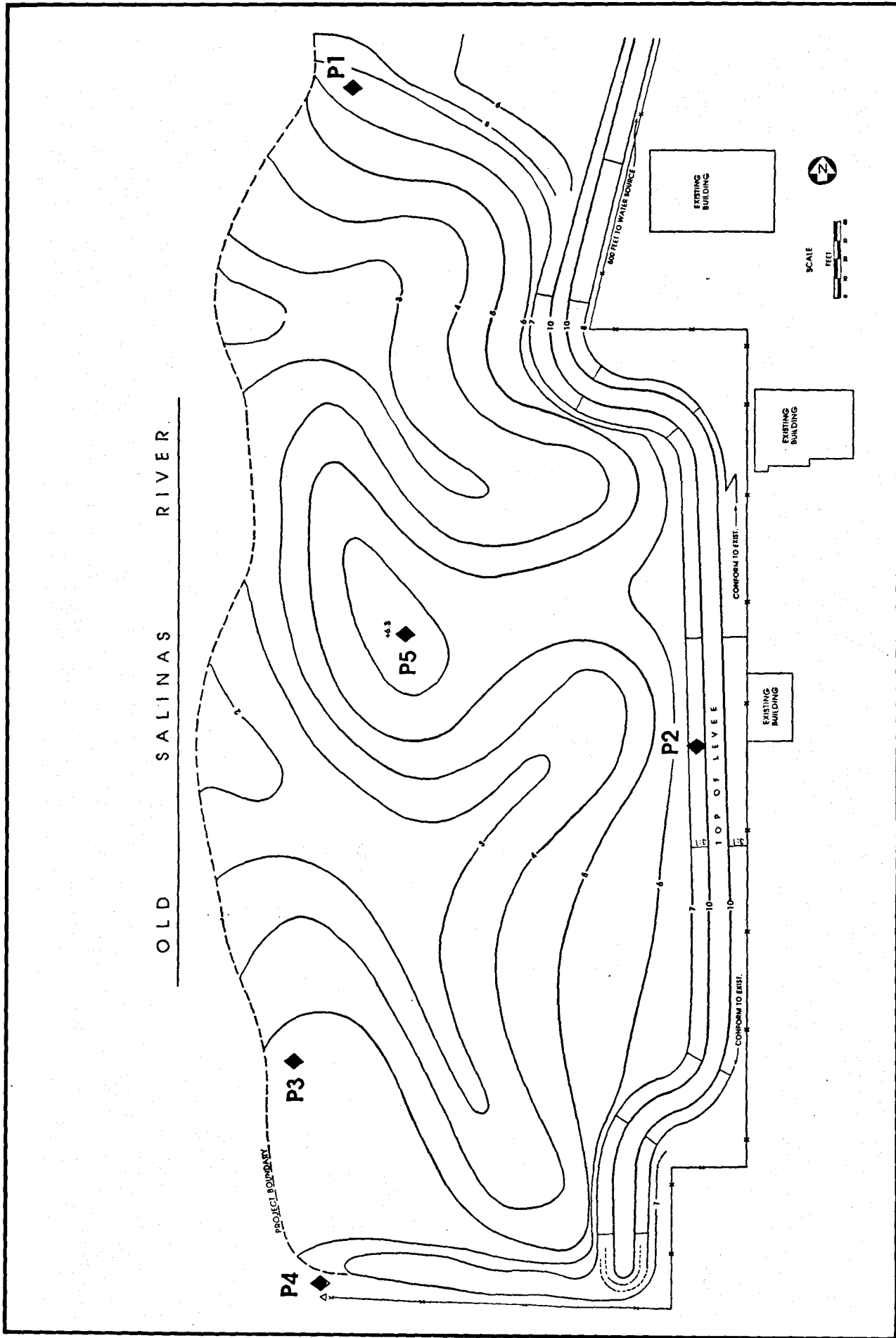
Figure 4

MOSS LANDING HARBOR
Location of plots where salvaged
Pickleweed marsh topsoil is placed.

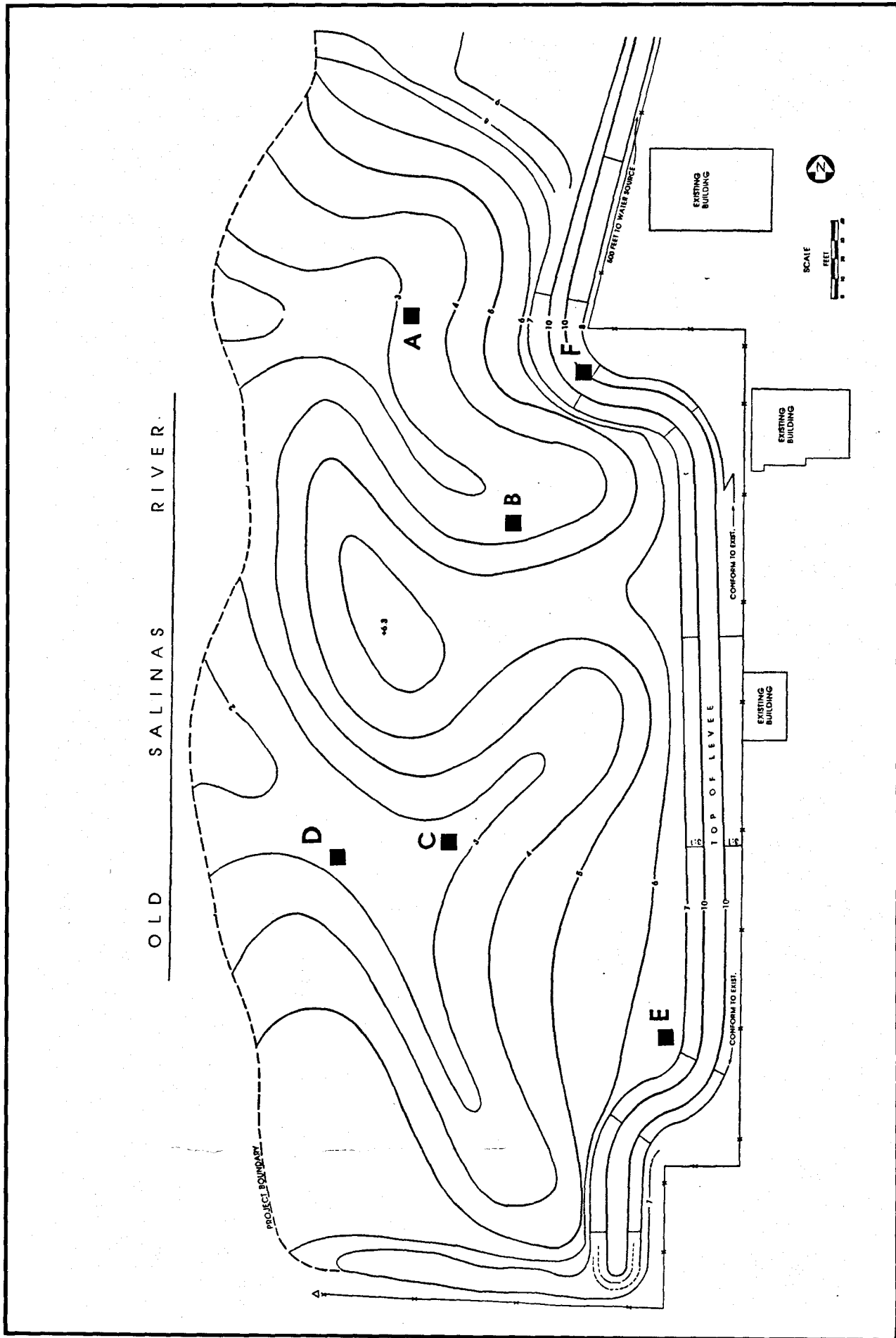
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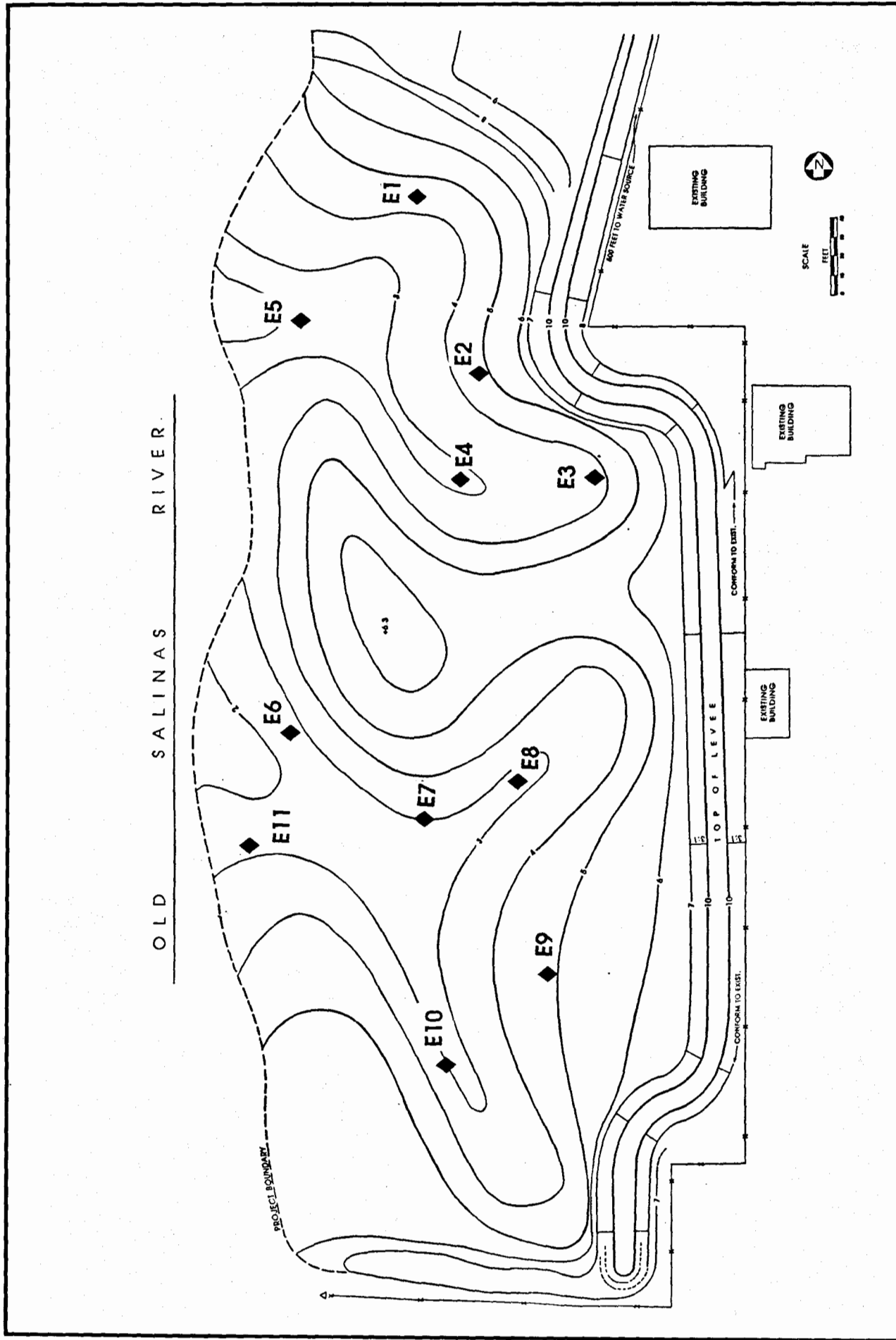
<p>The Habitat Restoration Group JOHN STANLEY & ASSOCIATES 6001 Butler Lane, Suite 1 • Scotts Valley, CA 95066 • (408) 439-5500 FAX (408) 438-1142</p>	<p>MOSS LANDING HARBOR Location of fixed photographic points from which to photograph the saltmarsh periphery vegetation</p>	<p>Figure 5</p>
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MOSS LANDING HARBOR
 Location of soil sample stations.

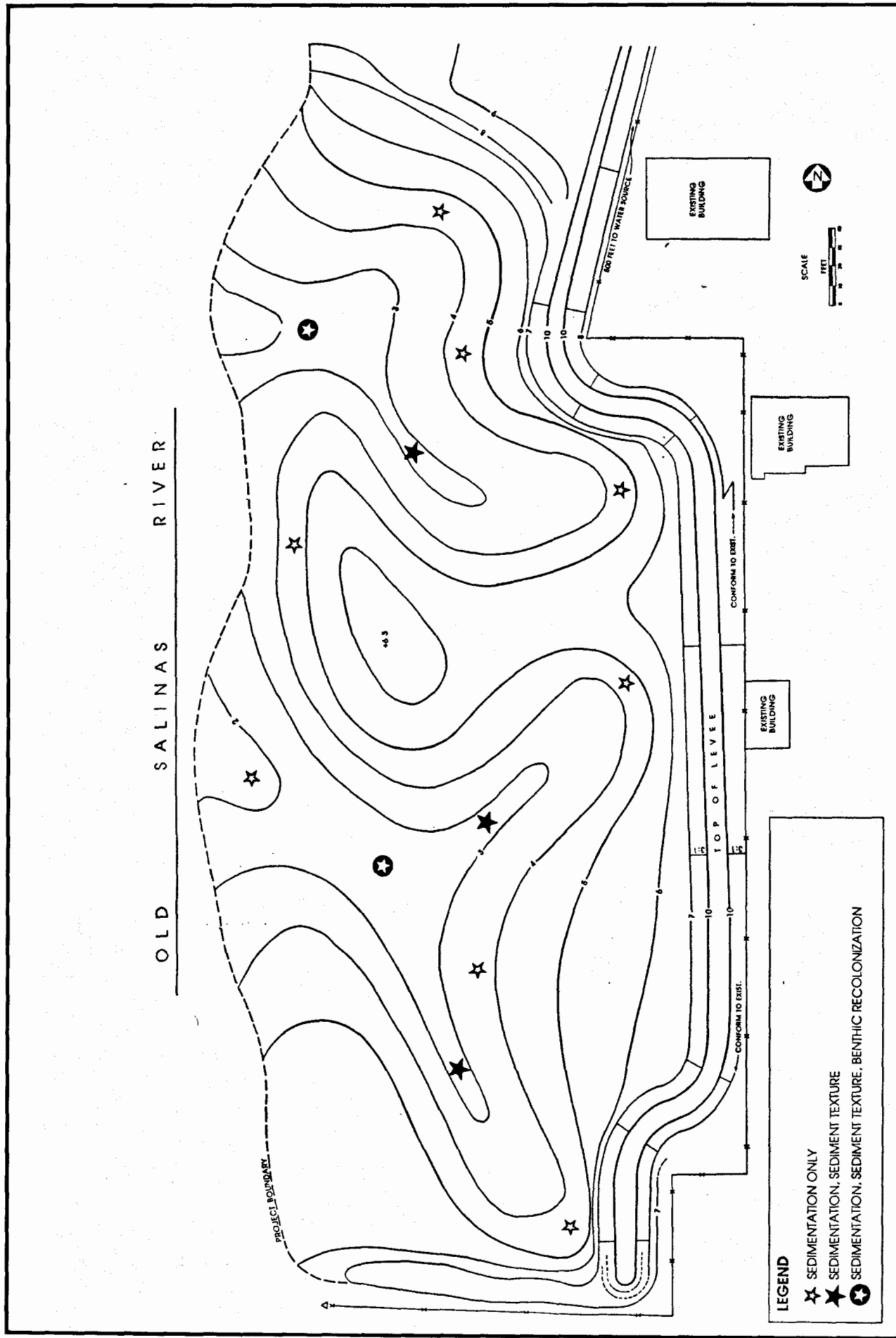
Figure 6



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MOSS LANDING HARBOR
 Location of elevation stakes to monitor
 depositional/transportational/erosional processes.

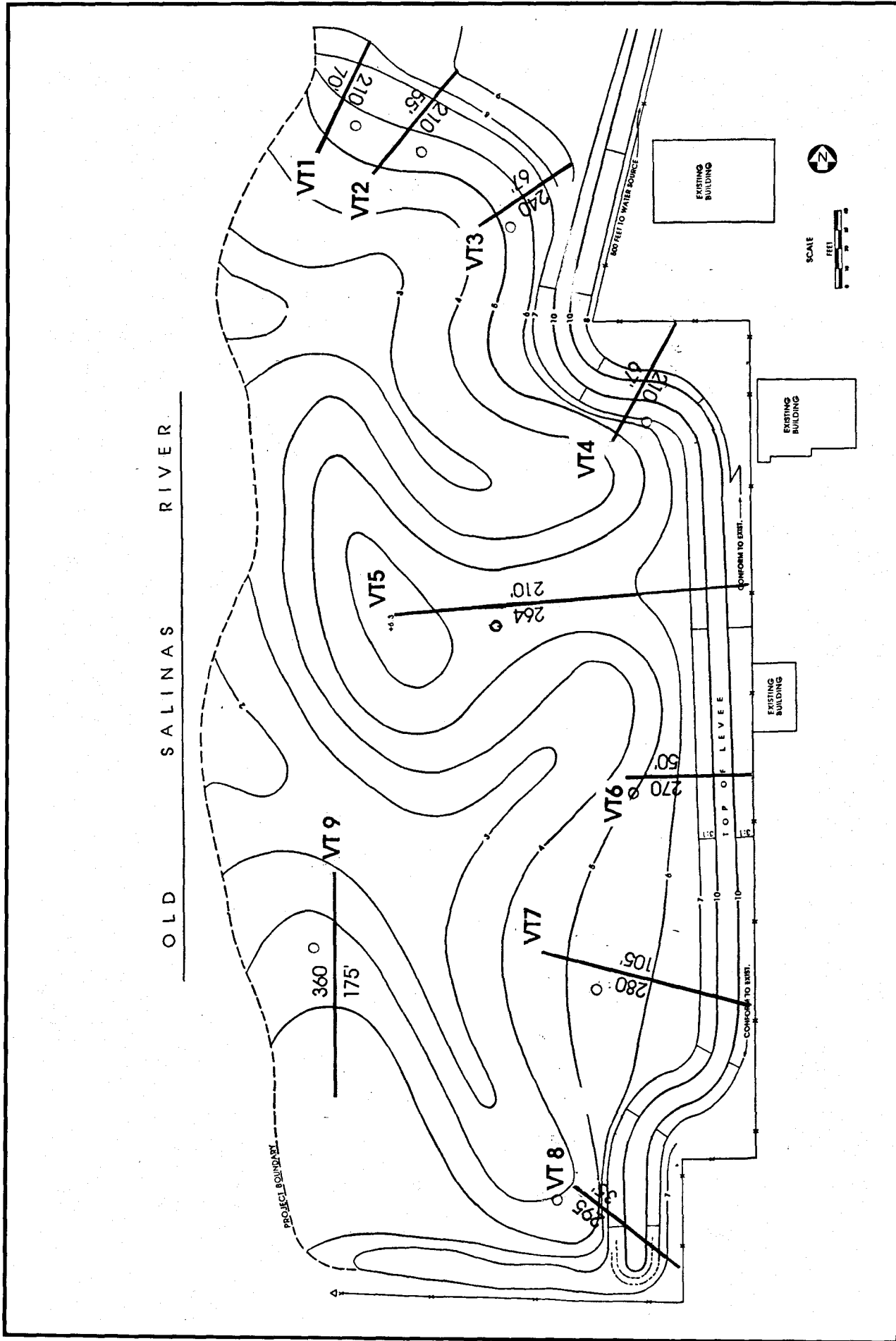
Figure 7



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MOSS LANDING HARBOR
 Proposed sampling stations for sedimentation, sediment texture, and benthic recolonization.

Figure 8



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MOSS LANDING HARBOR
 Station location of vegetation transects
 for salt marsh and peripheral upland.

Figure 9

APPENDIX A. Preliminary Results of the Bird Monitoring Program, August 17 to September 9, 1990.

The bird monitoring program was begun on August 17, 1990. Eighteen censuses of the restoration site have been completed, on eight survey days, through September 9, 1990. Additional information was gathered through casual observations during April to August, 1990.

Thirty-six waterbird species have been observed at the restoration site since grading and installation of the revegetation project. Thirty-five of these have been recorded during censuses conducted for the bird monitoring program. As of September 9, nine species of landbirds have been observed using the site. Table 1 presents a summary of the number of waterbird species and individuals recorded on the 18 censuses conducted from August 17 to September 9. Overall, the average number of waterbird species present on each census is 15.3, while the average number of individuals is 553. Table 2 presents preliminary census results for each waterbird species recorded during the surveys, including the average, maxima, minima, and percent of days and surveys when present.

As of September 9, 1990, the restoration site was receiving levels of waterbird use that are similar to the most heavily used portions of the Old Salinas River, between Sandholt Road and Potrero Road (D. Suddjian, pers. obs.). The restoration site is currently being used as a foraging area by shorebirds, and as a resting/roosting area by a variety of waterbirds. The exposed earth on the unvegetated portions of the site, particularly on the "marsh plain", has been observed to attract a regular mixed-species flock of resting waterbirds, including many species which typically do not use saltmarsh vegetation for resting/roosting (e.g., gulls, terns, pelicans, cormorants, and certain shorebirds). This use of the site was unanticipated, but is considered very significant, particularly given the large number of individuals using the site (see Table 2). Most notable among those using the site for resting/roosting are the large numbers of Elegant Terns (up to 426), and moderate numbers of Brown Pelicans (up to 74).

Waterbird species richness on the restoration site is greater than elsewhere along the Old Salinas River, due to the regular use of the site by resting/roosting Brown Pelicans and various species of gulls and terns (D. Suddjian, pers. obs.). As noted above, the bare earth attracts use by species which do not regularly use the pickleweed saltmarsh which occurs elsewhere along the Old Salinas River. Additionally, the variety of shorebirds which use the site is maximized by the heterogeneity of substrate-type and slopes, and the availability of bare mud substrate at all but the highest tides (in contrast to adjacent areas along the Old Salinas River, where mud substrates are only exposed at low tide). Twenty species of shorebirds have been observed foraging at the site, with hundreds of individuals regularly present during low tide.

Table 1. Number of Individual Birds and Species Recorded on each Survey Day, August 17 to September 9, 1990.

Date	Number of Surveys	Range of Number of Individuals	Range of Number of Species*
August 17	1	212	10
August 21	2	275-290	16-18
August 25	6	297-597	12-13
August 28	1	678	15
August 31	5	331-438	18-21
September 3	1	458	16
September 5	1	872	21
September 9	1	1099	20

* All dowitchers were recorded as the species-group "Dowitcher species", although both Long-billed Dowitcher and Short-billed Dowitcher were present on most surveys.

Table 2. Summary of Monitoring Data for each Waterbird Species, August 17 to September 9, 1990.

Species	Average	Maximum	Minimum (n=8)	Percent of Days Present (n=18)	Percent of Surveys Present
Brown Pelican	24.1	74	0	63 %	83 %
Double-cr. Cormorant	2.9	7	0	75 %	89 %
Great Blue Heron	0.1	1	0	13 %	6 %
Great Egret	0.3	1	0	38 %	28 %
Snowy Egret	0.3	1	0	13 %	28 %
Black-bellied Plover	0.2	2	0	25 %	11 %
Semipalmated Plover	1.9	13	0	63 %	50 %
Killdeer	4.7	8	1	100 %	100 %
Black-necked Stilt	14.2	37	1	100 %	100 %
American Avocet	0.3	2	0	38 %	17 %
Greater Yellowlegs	0.6	3	0	50 %	28 %
Willet	4.9	14	0	100 %	94 %
Spotted Sandpiper	0.6	1	0	50 %	56 %
Whimbrel	0.1	1	0	13 %	6 %
Long-billed Curlew	0.1	1	0	25 %	11 %
Marbled Godwit	1.1	7	0	63 %	56 %
Ruddy Turnstone	0.8	12	0	25 %	11 %
Sanderling	32.2	181	0	63 %	50 %
Western Sandpiper	29.4	182	0	75 %	61 %
Least Sandpiper	30.7	101	0	75 %	61 %
Pectoral Sandpiper	0.1	1	0	13 %	6 %
Baird's Sandpiper	0.1	1	0	13 %	6 %
Dowitcher species*	52.2	249	2	100 %	100 %
Red-necked Phalarope	0.1	1	0	13 %	6 %
Bonaparte's Gull	0.1	2	0	13 %	6 %
Heermann's Gull	29.7	87	0	63 %	81 %
Ring-billed Gull	7.9	17	1	100 %	100 %
California Gull	11.6	53	4	100 %	100 %
Western Gull	150.9	275	52	100 %	100 %
Glaucous-winged Gull	0.1	1	0	6 %	6 %
Caspian Tern	0.4	2	0	63 %	28 %
Elegant Tern	67.9	426	0	100 %	94 %
Common Tern	0.6	7	0	25 %	22 %
Forster's Tern	0.2	2	0	25 %	11 %
All Species	471.0	1099	212	---	---

* "Dowitcher species" included both Short-billed and Long-billed Dowitchers on most surveys.

APPENDIX B
MOSS LANDING SOUTH HARBOR RESTORATION PROJECT
REVEGETATION SCHEDULE

TASK A. April 3, 1990, 8:00 to 6:30

- ♦ Locate eight areas, each having an area of approximately 300 square feet in size, throughout the pickleweed marsh area.
- ♦ Transport salvaged top soil to restoration site using a front loader.
- ♦ Distribute salvaged pickleweed top soil to the eight areas and stockpile as close as possible to the pickleweed marsh area and the designated eight plots.
- ♦ Flagging of the irrigation ditch.
- ♦ Coordination of the CAB crew tasks and scope of work with Bruce Davis.

TASK B. April 4, 1990, 8:30 to 5:30

- ♦ Trench the irrigation ditch using a backhoe in the highly compacted areas beginning from the water source to start of project area, approximately 250 feet.
- ♦ Trench the irrigation ditch on the levee top.
- ♦ Pick up irrigation supplies.
- ♦ Begin installation of the irrigation system.
- ♦ Apply salvaged top soil to designated eight areas and spread to within 6 inches of finished grade.

TASK C. April 5, 1990, 8:30 to 5:50

- ♦ Cover designated eight areas with burlap and secure in place by using stakes.
- ♦ Assemble PVC supply line.
- ♦ Assemble first of two remote control stations of irrigation system.
- ♦ Assembly and lay out of electrical wires.
- ♦ Purchase of additional irrigation supplies.

TASK D. April 6, 1990, 8:00 to 4:30

- ♦ Conduct full water pressure test of completed supply line.
- ♦ Complete the second remote control valve assembly.
- ♦ Begin assembly of the drip tubing and secure lines in place by using wire stakes.
- ♦ Complete all electrical wiring.
- ♦ Manual testing of the operation of the first valve assembly.

TASK E. April 9, 1990, 8:30 to 5:30

- ♦ Flagging of salt grass planting areas beginning at the six feet elevation, i.e., from the toe of levee to the seven feet elevation on the slope.
- ♦ Prepare planting holes in designated salt grass marsh area.
- ♦ Begin cutting of salt grass sods from salvaged plant materials.
- ♦ Begin transportation of prepared salt grass sods to installation site. Approximately 14 grow flats per truck full.
- ♦ Water installed plants by hand, using hoses.
- ♦ Test the installed irrigation system portion (main line and electrical wiring) by using portable electrical generator.
- ♦ Pick up nursery grown plant material.

TASK F. April 10, 1990, 8:30 to 5:30

- ♦ C.A.B. crew absent.
- ♦ Delivery of additional nursery grown plant materials to the site by Sunset Coast Nursery.
- ♦ Preparation of planting holes in Pickleweed and salt grass areas by community workers (provided by the Harbor District).
- ♦ Plant salt grass sods retrieved from site in grow flats.
- ♦ Plant Grindelia stricta in one gallon containers.
- ♦ Water planted area by hose.
- ♦ Prepare planting holes in pickleweed marsh area.

TASK G. April 11, 1990 8:30 to 5:00

- ♦ Purchase additional irrigation supplies.
- ♦ Begin preparation of cutting salt grass sods into sod sections and transfer to grow flats.
- ♦ Transport sod sections to project site in the back of a pick-up truck.
- ♦ Prepare planting holes and install plants.
- ♦ Continue with installation of irrigation system.
- ♦ Begin bringing drip tubing to installed plants.

TASK H. April 12, 1990, 8:30 to 5:00

- ♦ Continue preparation of salvaged sod sections for transportation.
- ♦ Transport salvaged plants to project location.
- ♦ Continue installation of salvaged plants in pickleweed and salt grass marsh area.
- ♦ Continue bringing drip tubing to installed plants.
- ♦ Continue preparation of planting holes.
- ♦ Complete testing irrigation electrical connection by using a generator.
- ♦ Begin clean up operation of the site.

TASK I. April 13, 1990, 8:30 to 5:30

- ♦ Continue preparation of salvaged plants for transportation from nursery area to project site.
- ♦ Continue transportation of plants to project site.
- ♦ Continue preparation of planting holes.
- ♦ Continue installation of salvaged plants and salt grass sods.
- ♦ Continue bringing drip tubing to installed plants.
- ♦ Begin preparation of upland areas for planting.

TASK J. April 16, 1990, 8:30 to 5:30

- ♦ Back-fill irrigation trench using clean sand (without rocks) up to 4 inches on top of PVC line.
- ♦ Back-fill all areas where valve and electrical boxes are installed.
- ♦ Flagging of upland areas using different colored flag for each species.
- ♦ Prepare planting holes in upland areas (eastern slope of the levee).
- ♦ Bring one gallon pots to project location and place in designated planting areas.
- ♦ Preparation of salt grass sods at nursery (transfer to grow flats).
- ♦ Water all planted areas by hand.
- ♦ Watering of completely installed areas (northern slough area of the salt grass marsh).

TASK K. April 17, 1990, 8:30 to 5:30

[C.A.B. crew and Community workers (Harbor District)]

- ♦ Continue preparation of pickleweed marsh sods at nursery for transportation.
- ♦ Install nursery grown plant material in peripheral upland area.
- ♦ Transport sods and pickleweed to site and installation.
- ♦ Prepare and transfer of Elymus spp. to one gallon pots from salvaged plant material.
- ♦ Continue hand watering of planted area using hose and nozzle attached to quick couplers.
- ♦ Prepare planting holes.
- ♦ Install pickleweed sods in marsh area.

TASK L. April 18, 1990, 8:00 to 5:30

- ♦ Back-fill irrigation ditch using front loader.
- ♦ Complete preparation, transportation and installation of all areas of planting.
- ♦ Complete drip irrigation system installation.
- ♦ Hand watering of all installed areas.
- ♦ C.A.B. crew service terminated at 4:00 P.M.

TASK M. April 20, 1990, 8:00 to 5:30

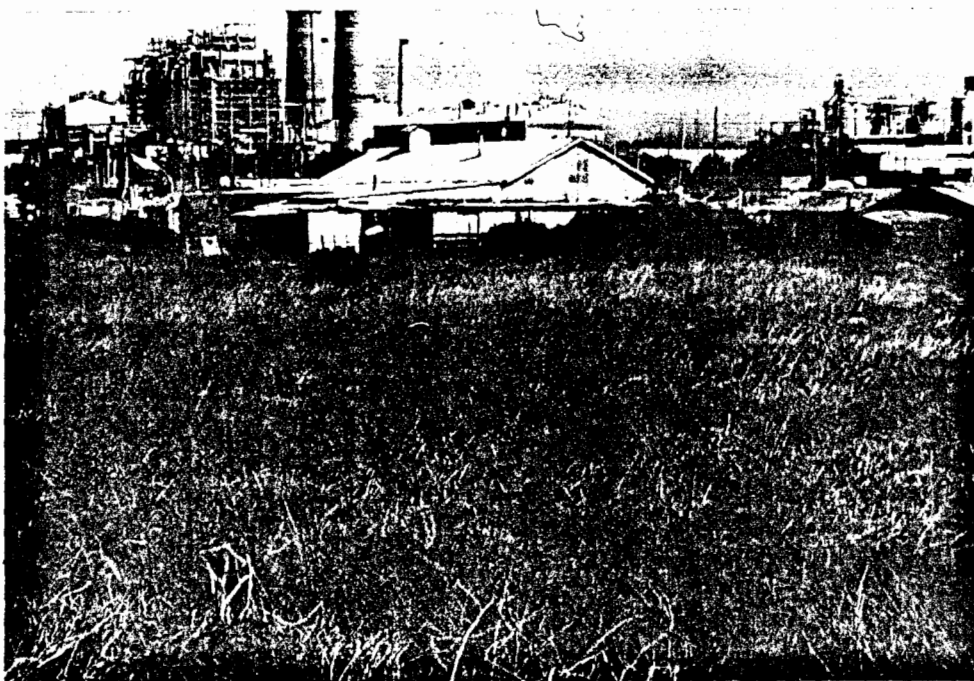
- ♦ Work with Bob (front loader) to establish path for front loader at eastern margin of the project so as to enable auguring for chain link fence, constructed by Harbor District.
- ♦ Remove debris from same area with front loader and load dump truck.
- ♦ Bring remaining salvaged plant materials to project site with front loader and deposit against fenced area at the north-eastern corner of the levee.
- ♦ Final count of plants in revegetated areas.
- ♦ Irrigation adjustment.
- ♦ Site visit by J. Gilchrist.

TASK N. April 22, 1990, 9:00 to 4:30

- ♦ Adjustment and some replacement of drip lines and emitters/bubblers.
- ♦ Bring irrigation line to area where salvaged plants are deposited.
- ♦ Clean up temporary nursery area and transport top soil used in heeling-in process to the project site. Deposit in stockpile area at the northern end of the project.

COMPLETION OF INSTALLATION PHASE OF REVEGETATION PROJECT.

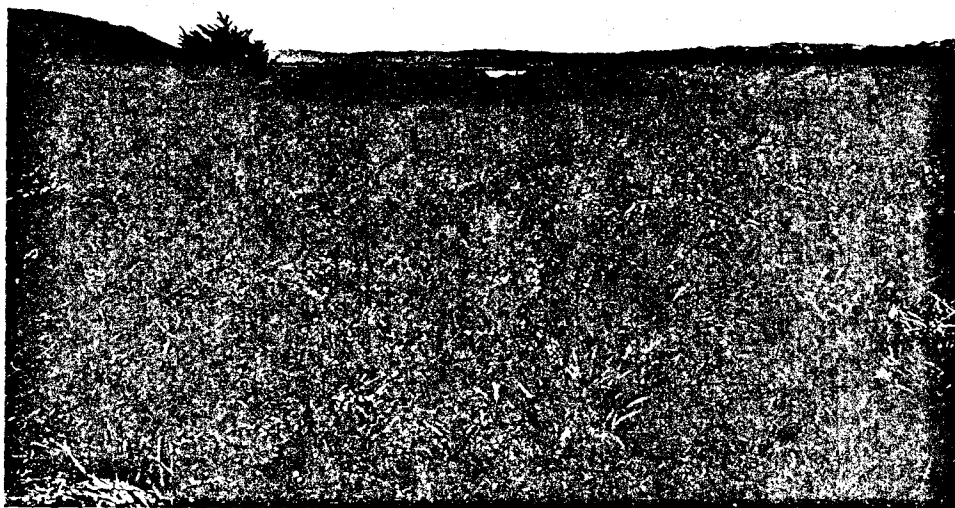
APPENDIX C.



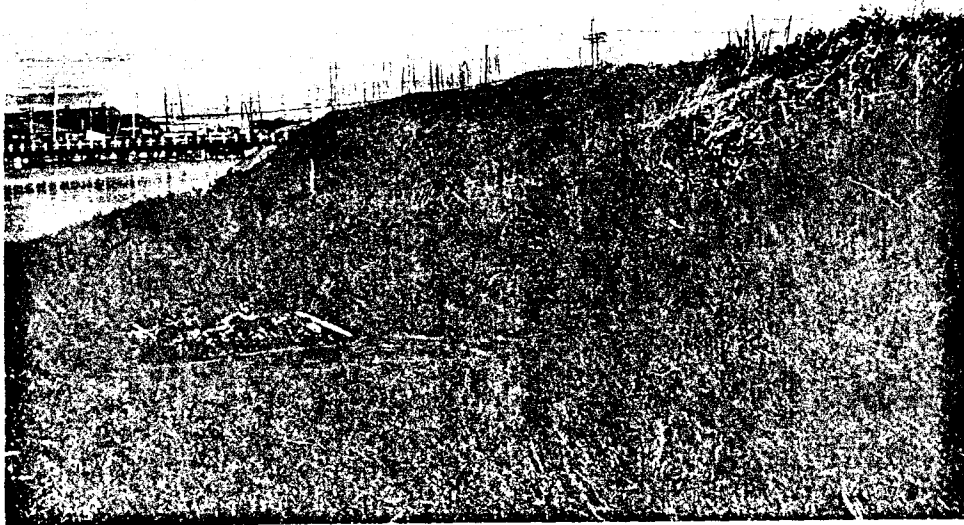
EXISTING CONDITION PRIOR TO EXCAVATION
NORTH-EAST CORNER OF PROJECT.



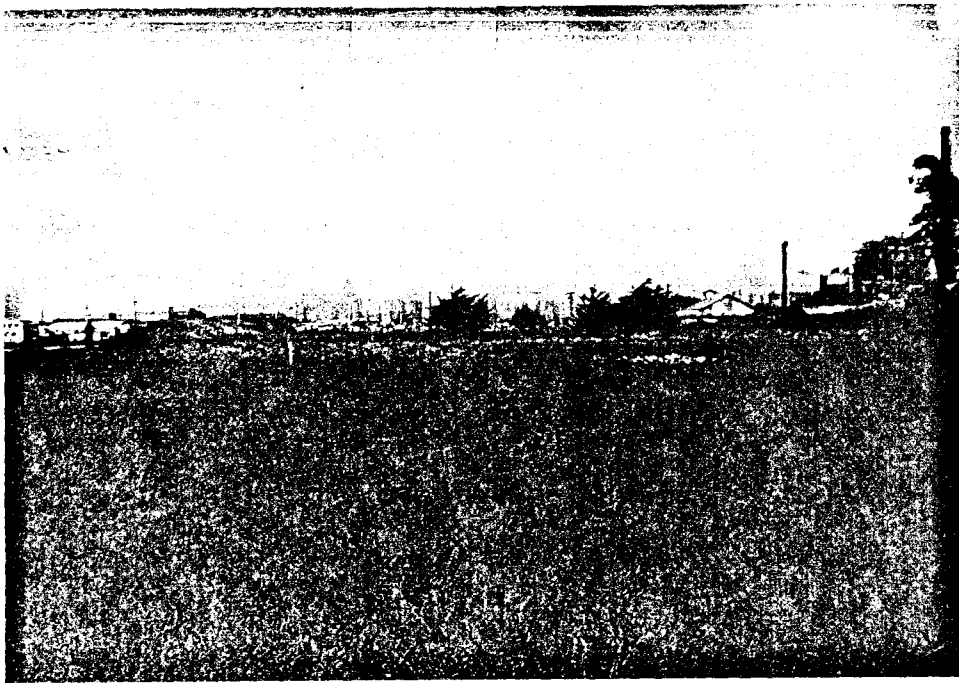
**EXISTING CONDITION PRIOR TO EXCAVATION
SOUTHERN ASPECT FROM TOP OF EXISTING BERM.**



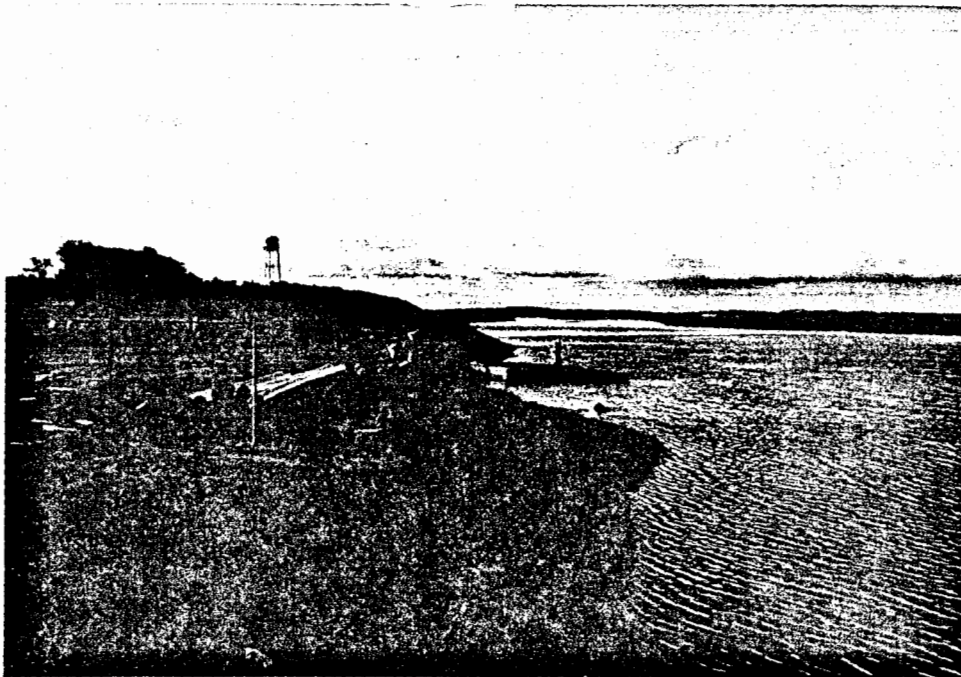
EXISTING CONDITION PRIOR TO EXCAVATION
SOUTH-WESTERN ASPECT, SHOWING WEEDY RUDERAL VEGETATION.



**EXISTING CONDITION PRIOR TO EXCAVATION
WEST FACING SLOPE OF BERM**



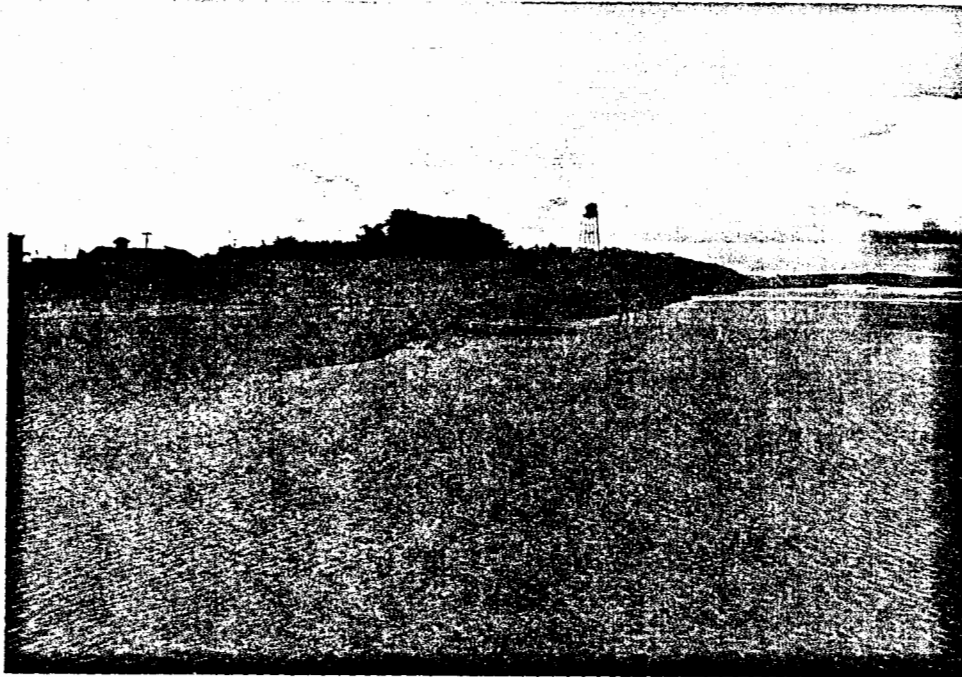
**EXISTING CONDITION PRIOR TO EXCAVATION
NORTH-EASTERN ASPECT**



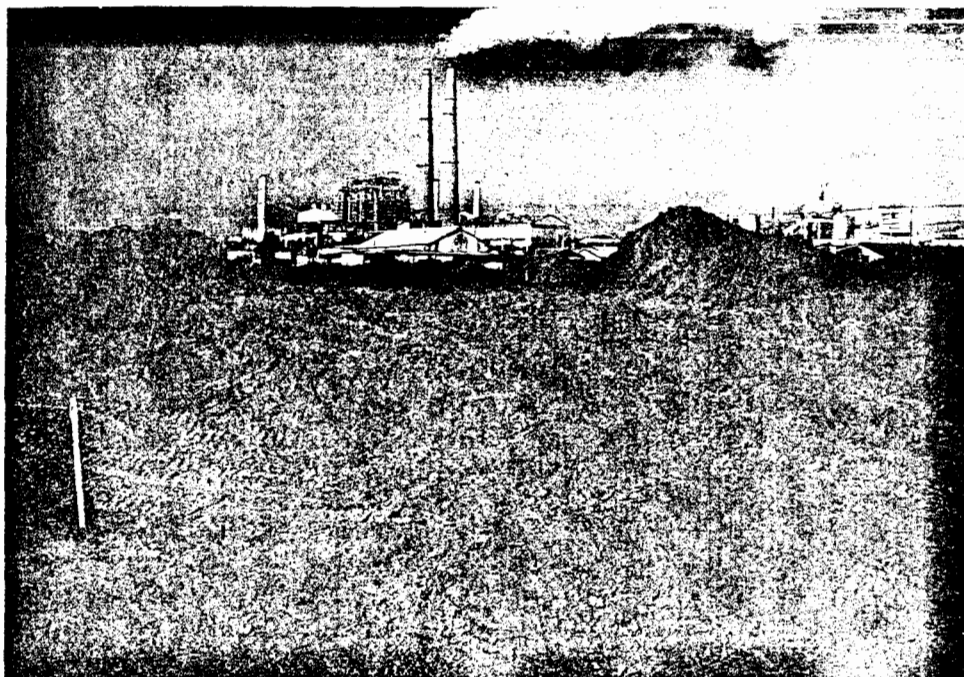
EXISTING CONDITION PRIOR TO EXCAVATION
WESTERN ASPECT, SHOWING EXISTING SHORE LINE.



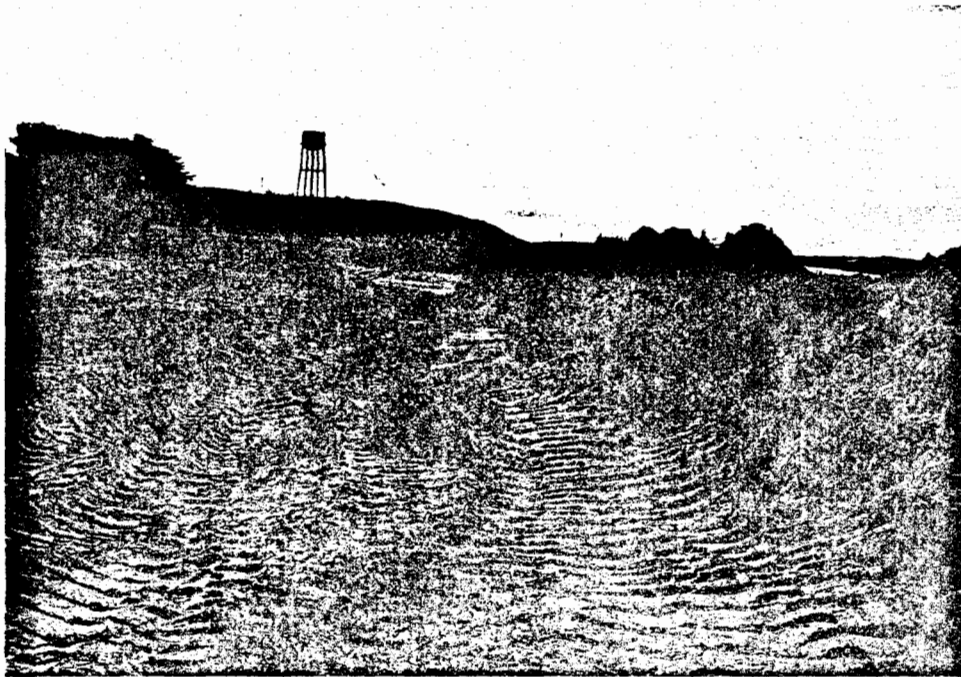
EXISTING CONDITION PRIOR TO EXCAVATION
EASTERN ASPECT, VIEW FROM THE TOP OF THE BERM.



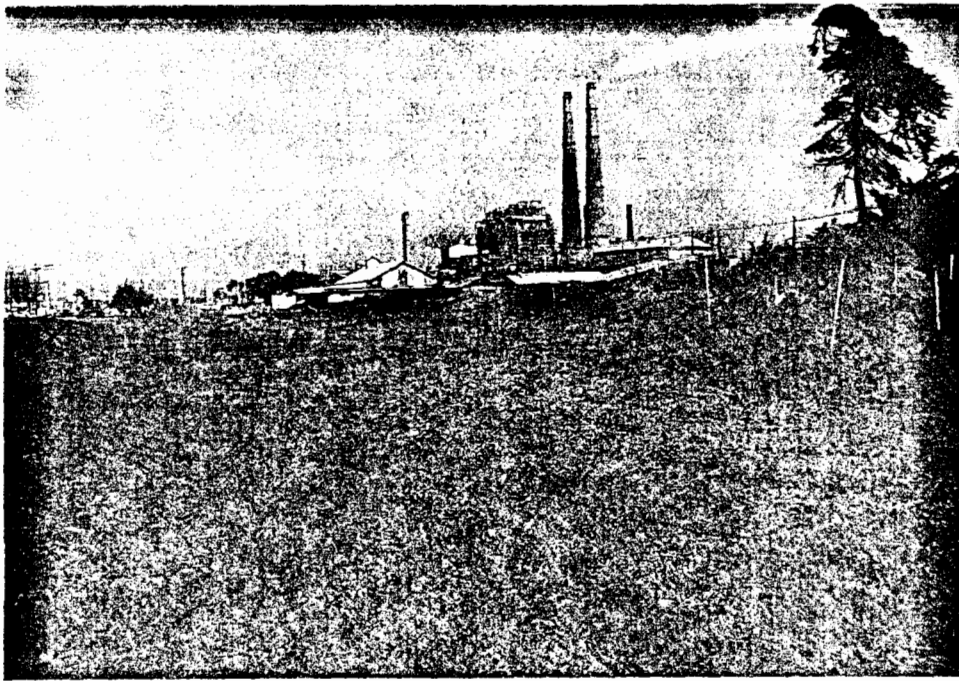
EXISTING CONDITION PRIOR TO EXCAVATION
WESTERN ASPECT, VIEW FROM ACROSS OLD SALINAS RIVER CHANNEL.



EXCAVATION OPERATION



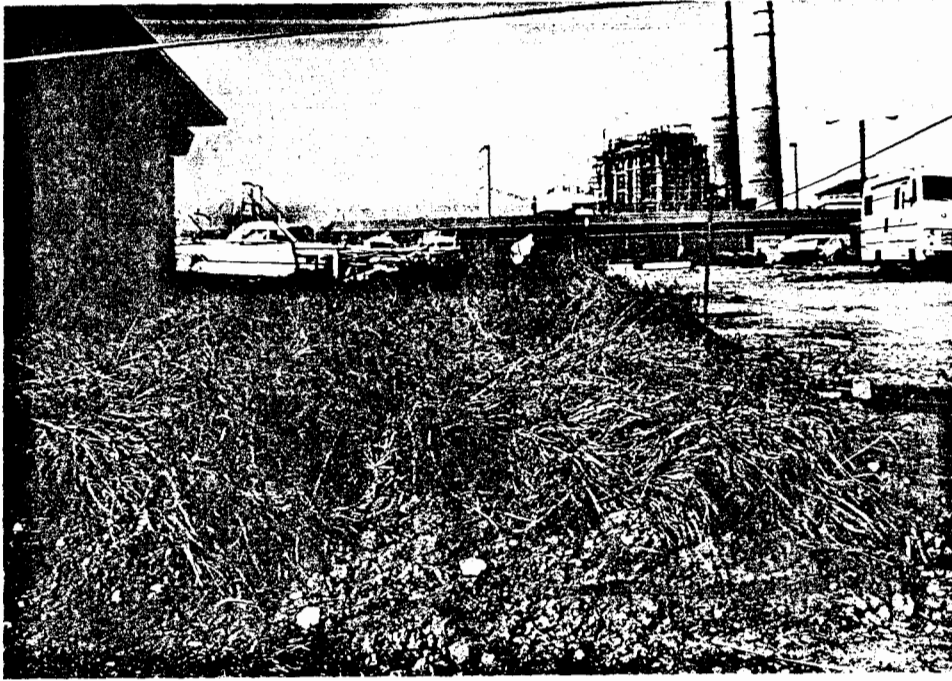
CONSTRUCTION OF THE MARSH PLAIN AND MUDFLAT
PRIOR TO BREACHING OF THE EXISTING LEVEE.



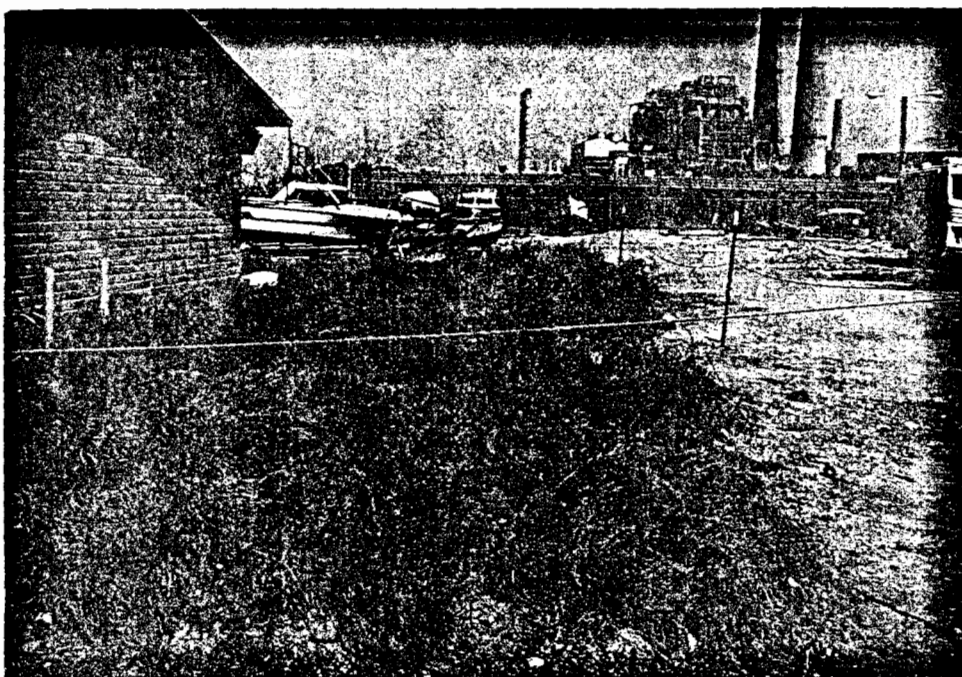
CONSTRUCTION OF THE NEW LEVEE.



THE NEWLY CONSTRUCTED LEVEE, SHOWING THE NEW MARSH
PLAIN, SLOUGH AND MUDFLAT AREAS.



THE TEMPORARY NURSERY AREA.



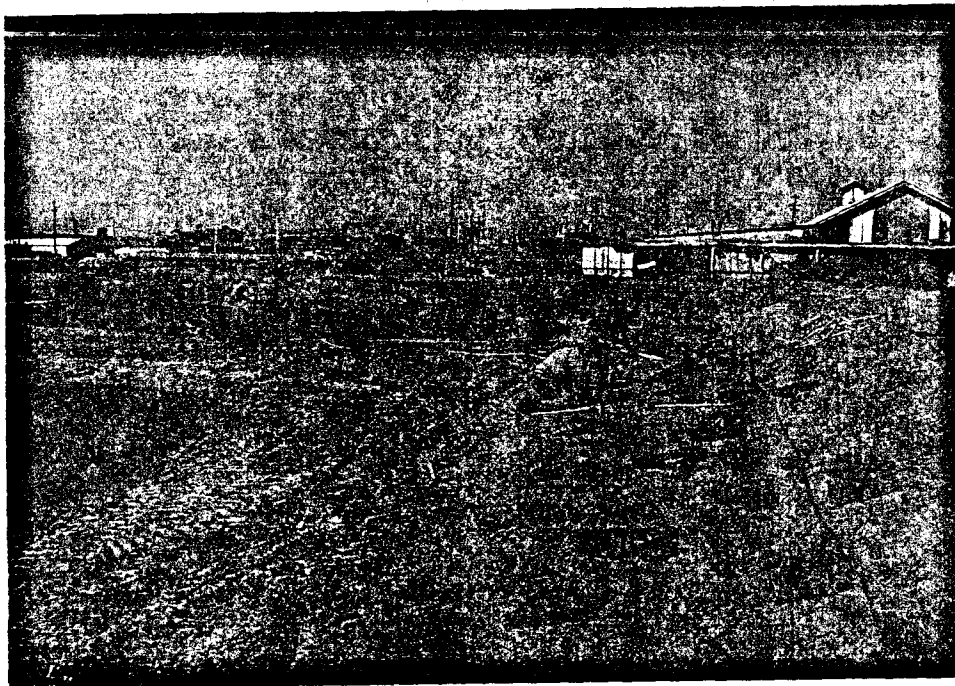
**SALVAGED PLANT MATERIALS (SALTGRASS AND
PICKLEWEED) AT THE TEMPORARY NURSERY AREA.**

**PREPARATION OF SALVAGED PLANT MATERIALS
FOR REPLANTING AT THE NURSERY SITE.**

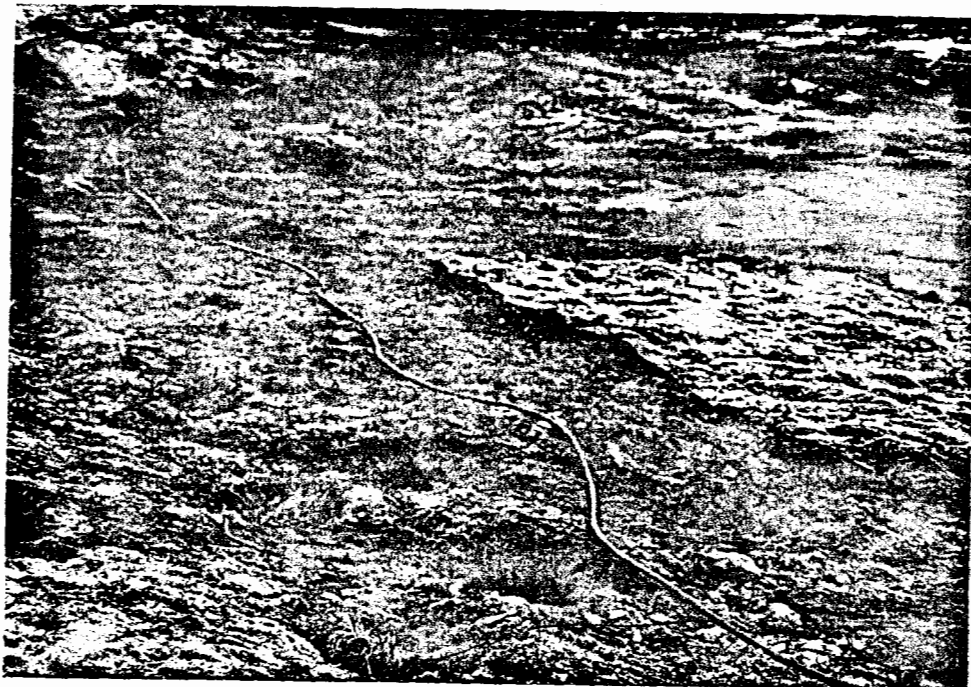


**SALVAGED *Spergularia macrotheca* SOD SECTION
PREPARED AND CUT FOR REPLANTING.**





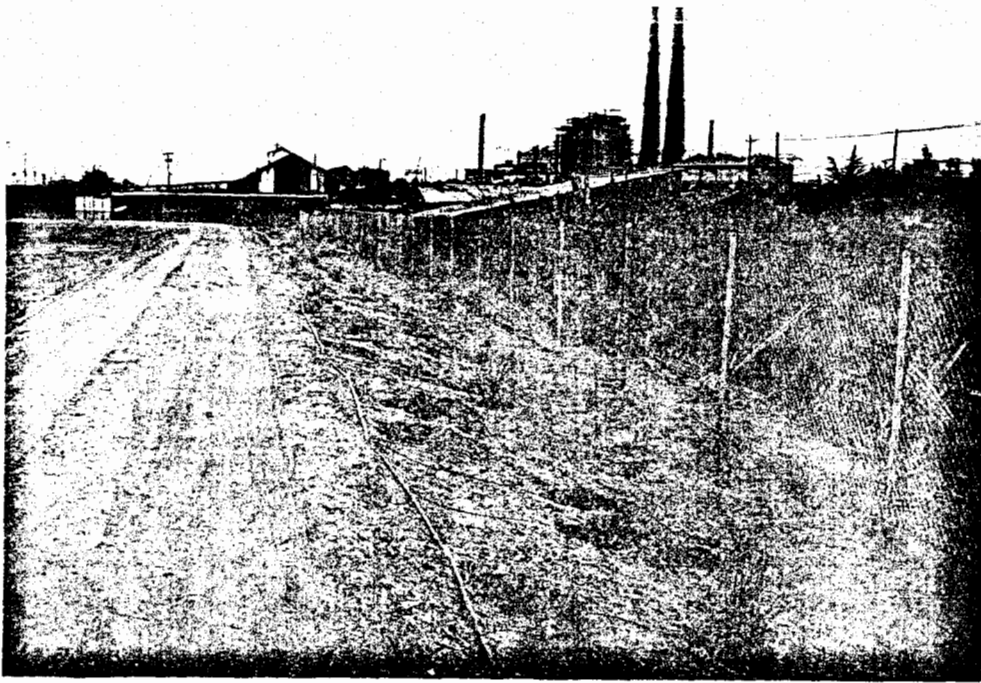
**C.A.B. CREW REPLANTING SOD SECTIONS OF
SALTGRASS ON NEWLY CONSTRUCTED LEVEE.**



REPLANTED LEVEE SHOWING PLANTING BASINS WITH
SALTGRASS SOD SECTIONS AND DRIP IRRIGATION SYSTEM.

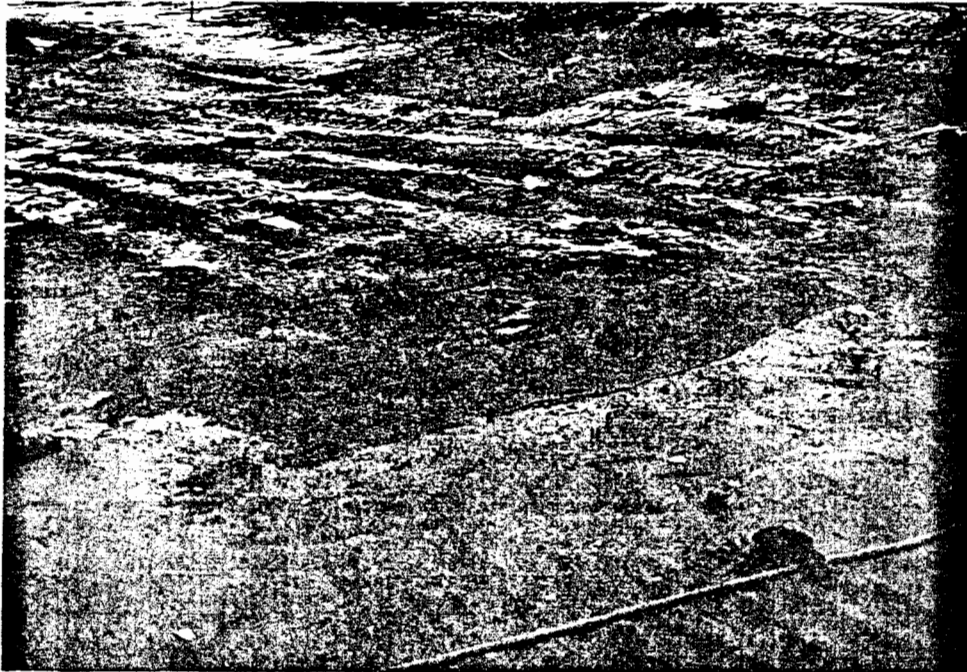


REPLANTED WESTERN SLOPE OF THE NEWLY CONSTRUCTED LEVEE.



REPLANTED EASTERN SLOPE OF THE NEWLY CONSTRUCTED LEVEE.

**PROPAGULES OF PICKLEWEED ASSOCIATION PLANTS
FOUND IN SALVAGED TOPSOIL SHOWING SIX WEEKS
OF GROWTH AFTER APPLICATION**





PROPAGULES IN SALVAGED TOP SOIL OF PICKLEWEED MARSH
SHOWING EIGHT WEEKS OF GROWTH AFTER APPLICATION