Chapter 4
PROJECT DESCRIPTION

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One of the ways to restore tidal wetlands is to deposit dredged materials in diked baylands to raise the low-lying areas behind dikes to an elevation suitable for growing marsh vegetation. The dikes surrounding the area are then breached and tidal water can flow over the dredged materials. Marsh vegetation can colonize on dredged materials, if environmental conditions are favorable.

The purpose of the Montezuma Wetlands Project is to combine the commercial disposal of dredged materials with the restoration of a tidal wetland ecosystem, by using approved dredged materials to raise the subsided land to elevations suitable for restoration of tidal marsh. The project would use "cover" and "non-cover" dredged materials (see section 2.3) taken from the San Francisco Bay Area to restore Bay Area tidal marsh, including some seasonal wetland features. The applicant proposes to use approximately 17 million cubic yards of dredged materials to restore 1,720 acres of tidal wetlands, create 109 acres of managed wetlands, and construct a commercial dredged sediment offloading and rehandling facility on a 2,394-acre site. The following chapter discusses the location and setting of the project, along with specific elements of the project proposal. Alternatives to the project are discussed in Chapter 5.

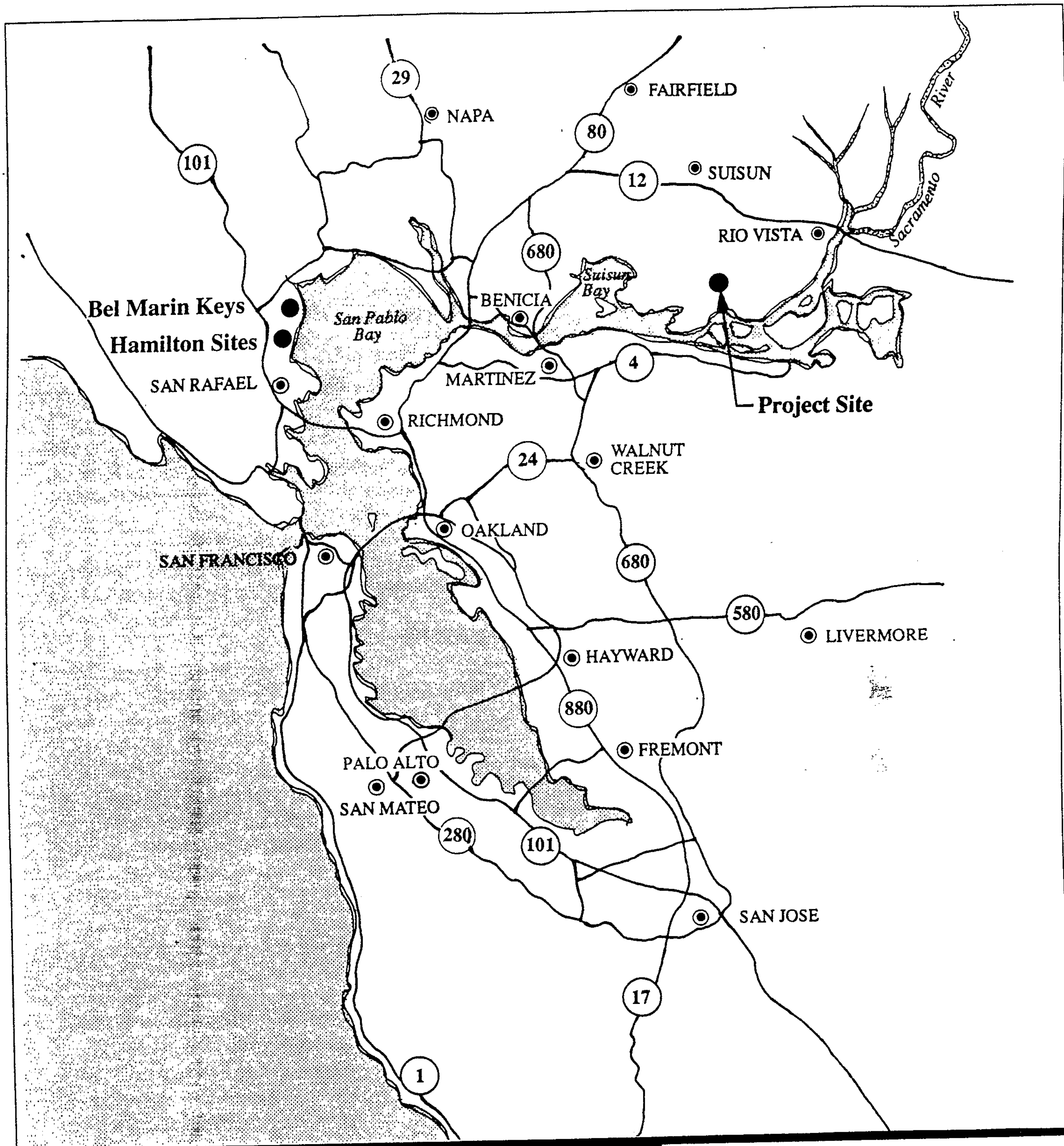
4.1 Location and Setting

The Montezuma Wetlands Project site is situated near Collinsville in the Suisun Marsh in Solano County. The site is located at the eastern edge of the marsh about 17 miles southeast of Fairfield. It is bordered on the south by the Sacramento River and on the west by Montezuma Slough. The Potrero Hills lie several miles north of the site and the Montezuma Hills are located to the east. Access is via State Route 12, Shiloh Road, Birds Landing Road and Collinsville Road. The regional location is shown in Figure 4.1-1 and the local setting is shown in Figure 4.1-2. Prevailing land uses consist primarily of sheep and cattle grazing, and recreational duck and pheasant hunting. A small area at the southeast end of the site is used for oyster shell processing, and the State Department of Water Resources (DWR) has a Day Use Area adjacent to Montezuma Slough which is used for recreational fishing, boating, and picnicking.

4.2 Project Overview

At project completion, the constructed tidal marsh plain would be separated into high marsh and low marsh, which would be separated by contoured and graded cell levees. High and low marsh are characterized by their elevations in relation to tide levels, and by the frequency and duration of tidal inundation. Frequency of inundation describes the number of times each year, expressed as a percent of total number of high tides, when a given elevation will be flooded by the tide. Duration of inundation describes the length of time each year, expressed as a percent of total time, that a given elevation will be flooded by the tide. Each marsh type supports distinct vegetation and associated wildlife habitats.

The high marsh would occupy 145 acres (8 percent of the site), and would have an elevation of mean higher high water (MHHW). The low marsh would occupy 1,440 acres (79 percent of the site) plus 80 acres of intertidal channels, and would have an elevation of 0.5 feet below mean high water (MHW). Other landscape elements on the site would include the following:

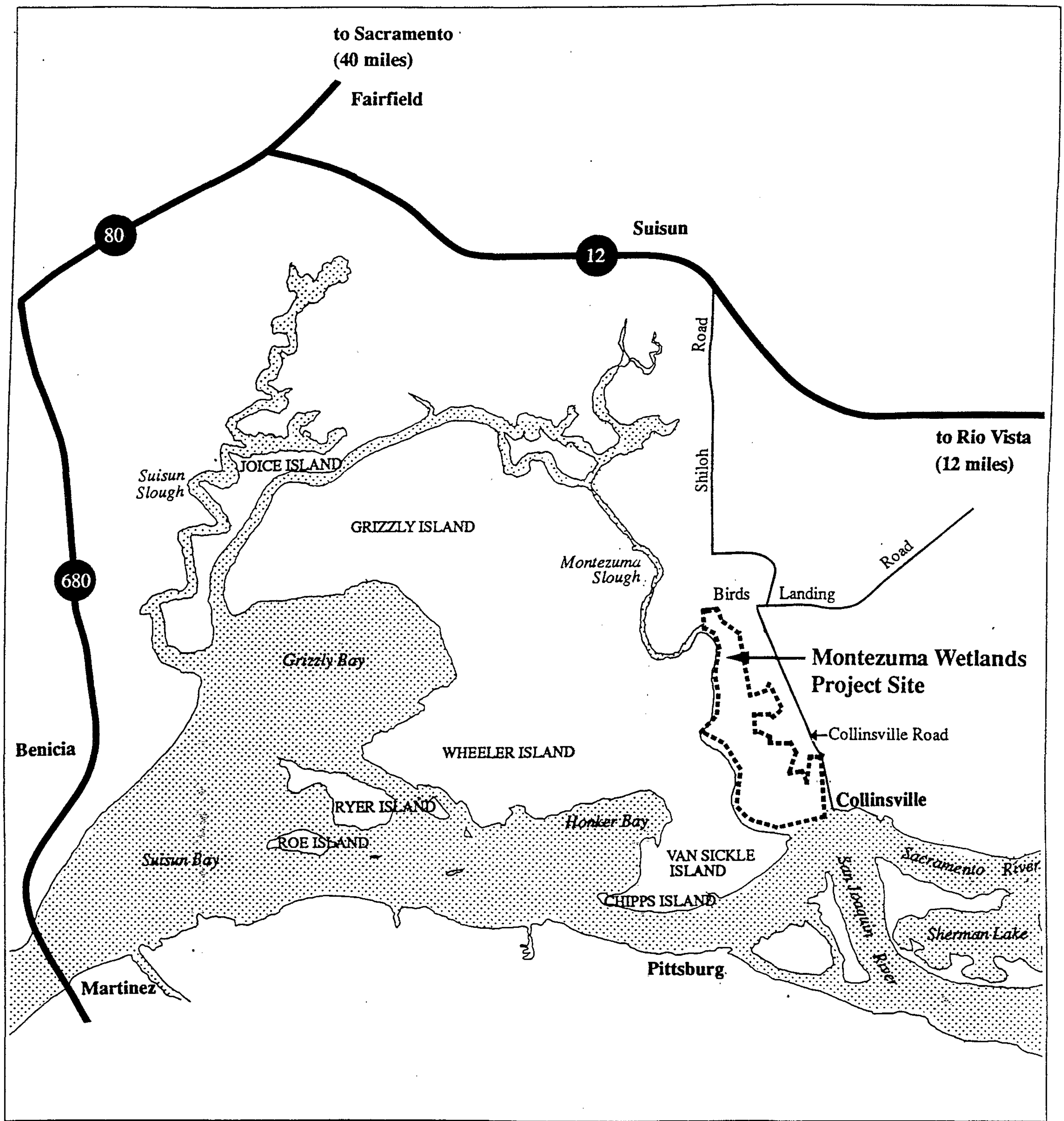


Source: Brady and Associates (1994)

MONTEZUMA WETLANDS PROJECT
EIR EIS

Figure 4.1-1

Regional Location



Source: Brady and Associates (1994)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.1-2

Site Vicinity: Montezuma Wetlands

- 6.6 acres of intertidal ponds (located within the high marsh and flooded by the highest tides, high groundwater levels, and direct rainfall input);
- 43 acres of seasonally wet depressions (located along the upland edge of the high marsh, and flooded by winter rains, high groundwater levels, and very infrequent tidal inundation);
- 48 acres of diked pickleweed marsh (a diked marsh managed by means of screened water control structures to optimize the growth of pickleweed);
- 61 acres of fluvial hollows (low-lying, remnant stream channels located at the lower edge of the upland transition zone). All of the fluvial hollows will be subject to tidal action; five of them will be managed by means of water control structures, either to optimize pickleweed growth, or to provide habitat for shorebirds; the largest hollow will function as a large intertidal pond, subject to unregulated tidal action.
- 6.5 acres of nesting and loafing islands (elevated [to MHHW] sections of channel banks that would function as windbreaks and provide nesting and loafing habitat for birds);
- 20 acres of levees; and
- 380 acres of an upland transition and buffer zone.

The landscape elements and acreage proposed for each are shown in Table 4.2-1.

The Project is designed to be constructed in four phases so that wetland functions and values are restored at a rate that will mitigate short-term impacts to existing wetland resources. The phased design also allows the Project to be adaptively managed so that monitoring and mitigation results from earlier phases can be incorporated into the design and management of subsequent phases. The Applicant has proposed that certain restoration and mitigation objectives be achieved before the initiation of a new phase. These objectives encompass a range of engineering, sediment quality, water quality, and ecological aspects that will be monitored on an ongoing basis throughout the life of the project. An outline of the major objectives and the phases in which they must be achieved before initiating a subsequent phase is presented in Table 4.2-2.

Verification that the objectives identified in Table 4.2-2 have been met would be provided through project monitoring as discussed in section 4.8. The objectives contained in Table 4.2-2 may be modified or additional mitigation and monitoring requirements added as a result of EIR/S mitigation measures or lead agency requirements.

The "Engineering Objectives" in Table 4.2-2 indicate the Applicant's commitment to construct and maintain each phase of the project within permitted specifications with regard to the layout of project facilities and the placement of sediment within specified horizontal and vertical limits. Sections 4.3 and 4.6 of this chapter provide additional details. "Sediment & Water Quality Objectives" provide assurances that contaminant concentrations in sediment, surface water, and groundwater in recently completed phases will remain within approved limits as a condition of continuing project implementation. As indicated in the table, these standards are to be met without impacting groundwater supplies in neighboring wells. Section 4.6.3 provides additional relevant details on proposed water management. Sections 6.6 and 6.7 assess the need for additional or more specific measures.

"Ecological Mitigation Objectives" reflect the need to replace, during the earlier phases (1 and 2) of the project, certain ecological functions and values that would be lost, at least temporarily, as a result of project implementation, whereas "Ecological Restoration Objectives" make continuing implementation of

Table 4.2-1
Acreages Of Landscape Elements for the Montezuma Wetlands Project

Landscape Element	PHASE I		PHASE II		PHASE III		PHASE IV		TOTAL	
	acres	*%*	*acres*	*%*	*acres*	*%*	*acres*	*%*	*acres*	*%*
Wetland Elements										
Intertidal Channels										
Main channels	21.9	3.0	15.8	3.1	8.9	2.5	20.4	3.2	67.0	2.8
Point bars (for fish)	4.2	0.6	2.9	0.6	1.6	0.4	3.8	0.6	12.5	0.5
Intertidal Marsh Plain										
Low marsh	392.5	54.3	371.3	74.0	185.0	51.8	490.0	75.7	1,440.0	60.1
High marsh	65.4	9.0	0.0	0.0	40.0	11.1	40.0	6.2	145.0	6.1
Experimental Intertidal Ponds	6.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.3
Seasonally Wet Depressions	27.5	3.8	0.0	0.0	8.6	2.4	7.0	1.1	43.1	1.8
Diked Pickleweed Marsh	48.1	6.7	0.0	0.0	0.0	0.0	0.0	0.0	48.1	2.0
Managed Fluvial Hollows										
For salt marsh harvest mice	0.0	0.0	18.4	3.7	0.0	0.0	0.0	0.0	18.4	0.8
For shorebirds	0.0	0.0	13.9	2.8	0.0	0.0	0.0	0.0	13.9	0.6
Clank Hollow	28.8	4.0	0.0	0.0	0.0	0.0	0.0	0.0	28.8	1.2
Loafing and Nesting Islands	1.9	0.3	1.7	0.3	1.0	0.3	1.9	0.3	6.5	0.3
SUBT	596.8	82.6	424.0	84.5	245.1	68.6	563.1	87.0	1,829.0	76.4
Upland Elements										
Upland Transition and Buffer	120.0	16.6	73.0	14.5	108.1	30.2	79.0	12.2	380.0	15.9
Perimeter and Phase Levees	6.1	0.8	4.9	1.0	4.2	1.2	4.9	0.8	20.1	0.8
SUBT	126.1	17.4	77.9	15.5	112.3	31.4	83.9	13.0	400.1	16.7
Sediment Offloading and Rehandling Facility									165.0	6.9
TOTAL	722.9	100	501.9	100	357.4	100	647.0	100	2,394.1	100

Source: Table 2 from Levine-Fricke 1995a.

Table 4.2-2. General Project Objectives and Phasing Requirements
(page 1 of 2)

Objectives	*Phase in Which Objective Achieved*
Engineering Objectives	
Construct operating facilities and infrastructure according to design plans and specifications	All phases
Verify stability of cell, phase, and perimeter levees during and after sediment placement	All phases
Achieve fill elevations within permitted specifications for all landscape elements	All phases
Place dredged sediment within permitted specifications for cover and noncover sediment	All phase
Sediment & Water Quality Objectives	
Achieve sediment quality standards within the placement cells and within the makeup water pond	All phases
Achieve water quality standards in sediment cells, makeup water pond, shallow and deep groundwater, and in discharge	All phases
Operate groundwater pumping without impacting water quality and water level in nearby water supply wells	All phases
Ecological Mitigation Objectives	
Mitigate impacts to SMHM	Plant colonization by desirable species underway in Phase I before initiating Phase II, and progressing toward reference conditions before initiating Phase III Plant and wildlife colonization by desirable species underway in Phase II before initiating Phase III, and progressing toward reference conditions before initiating Phase IV
Mitigate impacts to waterfowl and shorebirds	Habitats in Phase I progressing toward reference conditions before impacting waterfowl and shorebird habitat in Phase II, and approaching or exceeding reference conditions before initiation of Phase III Habitats in Phase II progressing toward reference conditions before impacting waterfowl and shorebird habitat in Phase III, and approaching or exceeding reference conditions before initiation of Phase IV

Table 4.2-2. General Project Objectives and Phasing Requirements
(page 2 of 2)

Objectives	*Phase in Which Objective Achieved*
Mitigate impacts to vernal pools	Restore/mitigate impacted acreage before initiating Phase II.
Mitigate impacts to Mason's lilaeopsis	Avoid impacts or restore population in Phase I before initiating Phase III Avoid impacts or restore population in Phase II before initiating Phase IV
Mitigate impacts to burrowing owls	Nesting population equal to or exceeds recent/historical population in all phases
Ecological Restoration Objectives	
Support intertidal brackish marsh plant and wildlife communities	Plant and wildlife colonization in Phase I progressing toward reference conditions before initiating Phase III Plant and wildlife colonization in Phase II progressing toward reference conditions before initiating Phase IV
Support estuarine fishes	Fisheries habitat provided in Phase I before initiating Phase III Fisheries habitat provided in Phase II before initiating Phase IV
Support seasonally saturated and flooded plant communities	Seasonal wetland plant colonization in Phase I progressing toward reference conditions before initiating Phase III Seasonal wetland plant colonization in Phase II progressing toward reference conditions before initiating Phase IV

the project conditional upon progress toward the attainment of broad ecological goals for the restoration of tidal and seasonal wetland habitats. Section 6.8 evaluates the need for additional measures and/or specificity regarding these types of objectives.

The project's 1,720 acres of restored tidal wetlands and 109 acres of managed wetlands would be constructed in four phases, replacing an existing 1,620 acres of non-tidal jurisdictional waters and wetlands and 209 acres of uplands. The engineering design layout is shown in Figure 4.2-1. Figure 4.2-2 shows the entire project site at construction completion, including the proposed areas of marsh and uplands.

Once sediment placement operations begin at the Project site, wetlands habitats in unfilled phases will be enhanced by limiting the pumping of water from those phase areas. Existing pumps in the unfilled phase will be managed to maximize habitat for marsh plants and wildlife species (e.g., shorebirds, waterfowl, and the SMHM). This activity is designed to offset temporal impacts associated with sediment placement prior to wetlands establishment. As shown in Figure 4.2-2, the project site would be divided into four phase areas, separated by engineered levees that would also serve as access roads. Each completed phase would be hydrologically independent, each with a single connection to Montezuma Slough or the Sacramento River. Phases would range in size from about 350 to 725 acres, including an unfilled upland transition and buffer zone (see Table 4.2-1).

Within each phase area, a network of cells, ponds, and tidal channels would be constructed. The cells, which would contain the dredged material, would range in size from about 30 to 200 acres and would be separated by cell levees. Dredged materials would be placed within cells, and the dikes breached so that tidal waters enter the cells through the network of channels. When opened to tidal flows, this system is expected to recreate marsh conditions.

As shown in Figure 4.2-3, the project would include facilities for unloading of dredged materials from barges, sediment distribution facilities, access roads, ancillary facilities to support construction, operation and monitoring activities, improvements to the existing California Department of Water Resources (DWR) Day Use Area, and a new public access facility. Figure 4.2-4 shows the proposed sediment off-loading facility and the sediment rehandling facility. The off-loading facility would be located in the Sacramento River. The rehandling facility would dry clean dredged materials so that they can be used for on-site levee construction, or sold for off-site use. This EIR/EIS evaluates the impacts upon the Montezuma site that would result from activities and operations related to off-site sales, but does not evaluate the impacts of placing exported sediments at off-site locations.

Dredged materials that would be placed on the site may originate anywhere in the San Francisco Bay. Channel deepening projects and Corps channel maintenance projects may supply material. The dredged materials to be used for wetland restoration at the Montezuma Wetlands Project are classified as "cover" and "non-cover" material. These classifications are made based on the range of contaminants present in the material (see section 2.3). Cover material must be placed over non-cover material as a way to minimize the potential for release of contaminants. Because at least three feet of cover material must be placed on top of non-cover material, a site deep enough to accommodate both types of material is essential to project development.

To improve chances of successful marsh restoration, the design elevations of low and high marsh have been lowered to better accommodate natural sedimentation and the evolution of channel networks on the marsh plain. Schematic cross sections of the draft and revised designs are shown in Figures 4.2-5a and 4.2-5b, respectively. Tides would be allowed to enter each phase after target fill and grade elevations have

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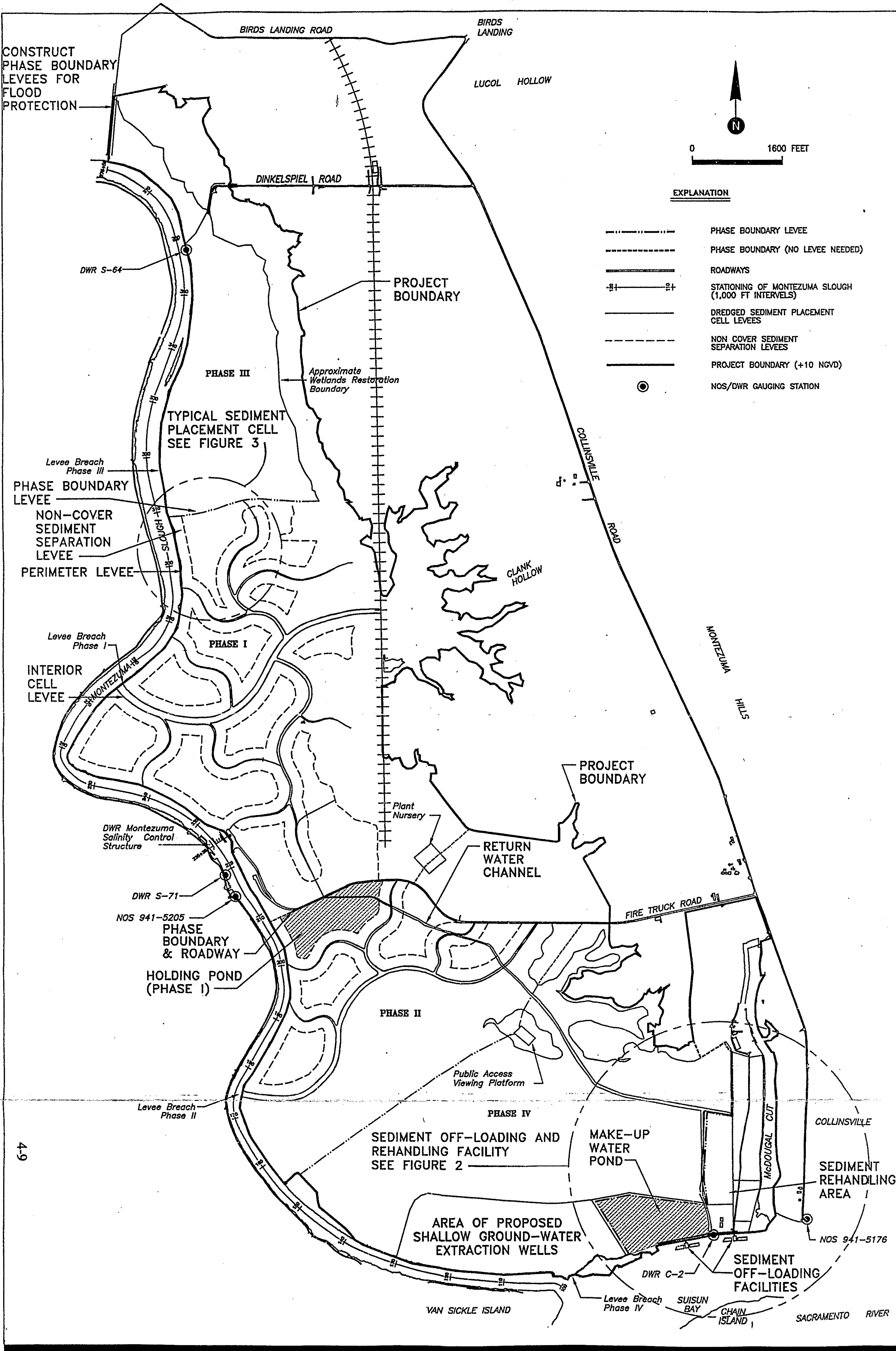

Source: Levine-Fricke (1995c)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.2-1

Engineering Design Layout

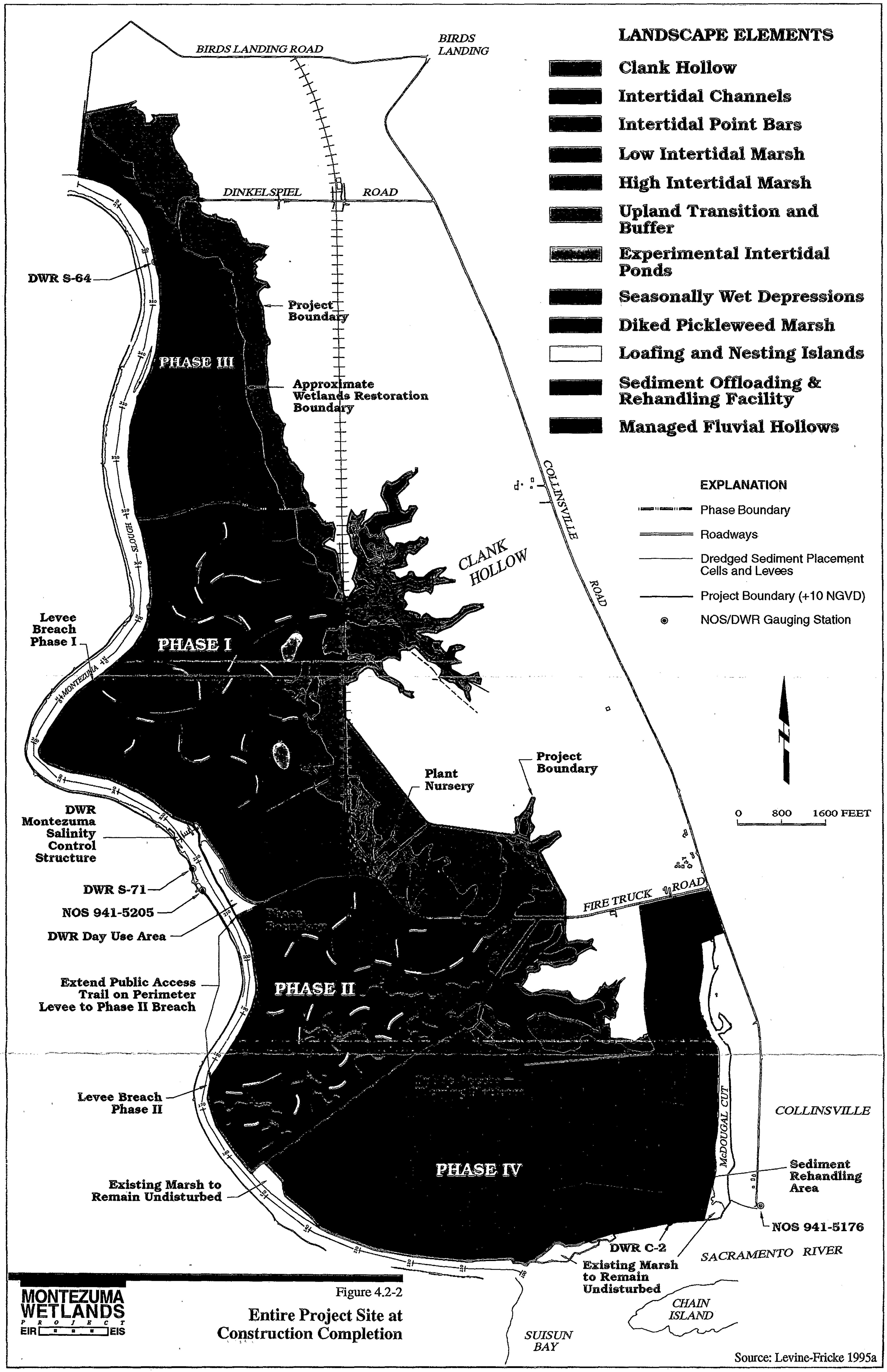

Figure 4.2-2

Entire Project Site at Construction Completion

Source: Levine-Fricke 1995a

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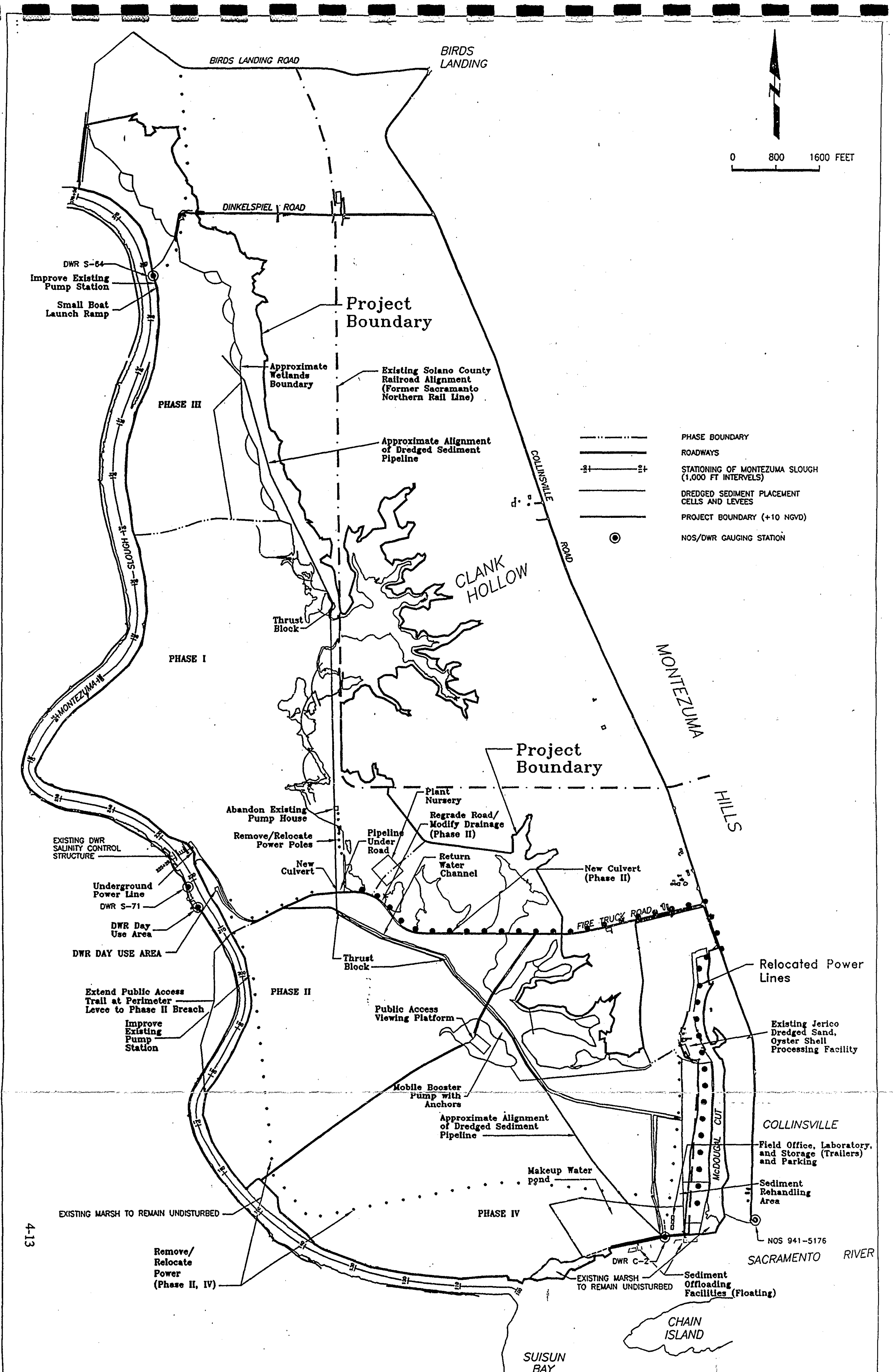

Source: Levine-Fricke (1995c)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.2-3

Proposed Project Facilities

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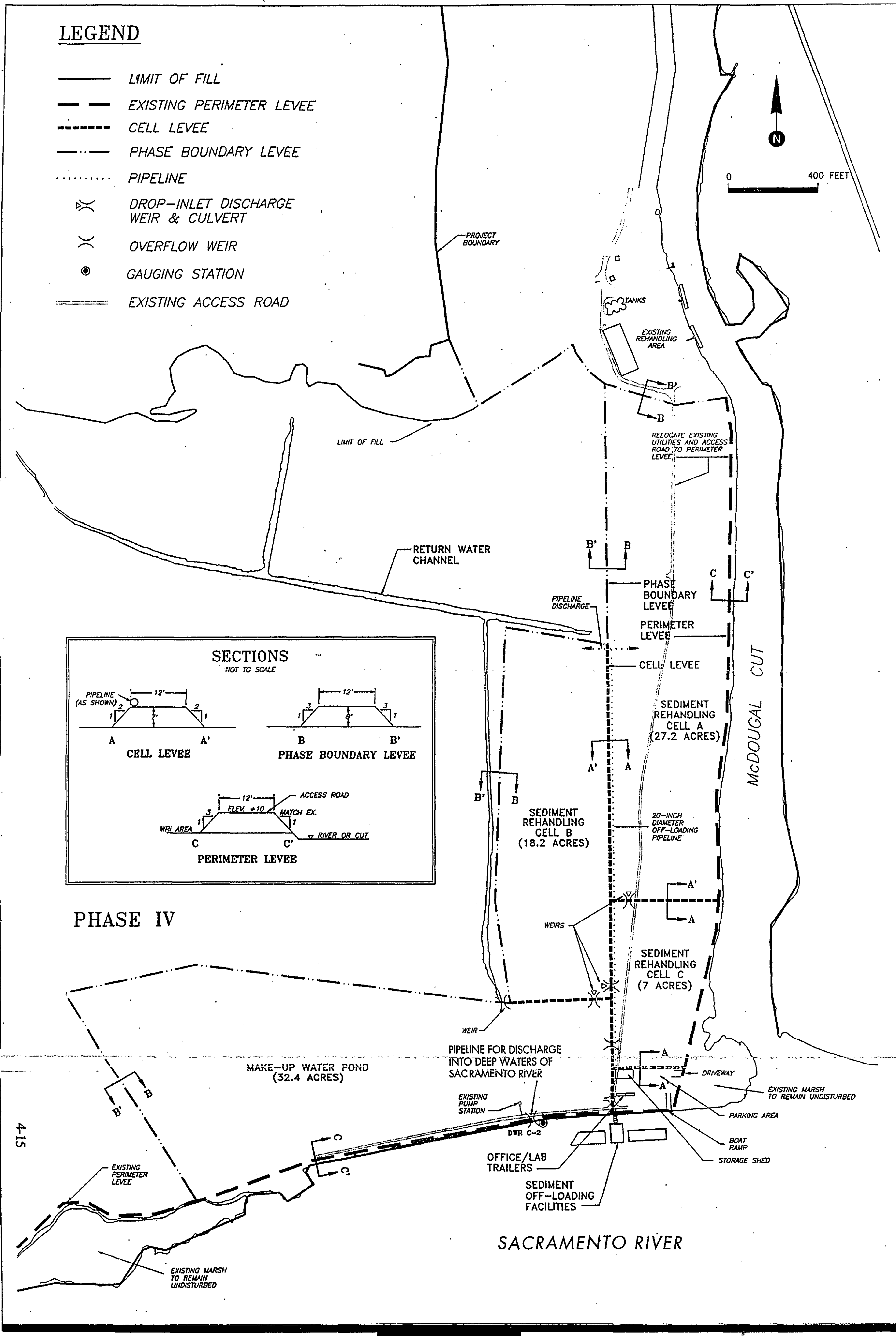


Source: Levine-Fricke (1995c)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.2-4

Sediment Off-Loading and Rehandling Facility Layout

been achieved, and revegetation operations within each cell have been conducted for at least one growing season. The last cells to receive sediment within each phase would be low marsh.

Permits, approvals and amendments to current local and regional plans and policies required for the project are identified in Chapter 1 of this EIR/EIS.

Facilities and activities associated with project construction and operation are summarized below, and shown in figures 4.2-2 and 4.2-3.

4.3 Project Details

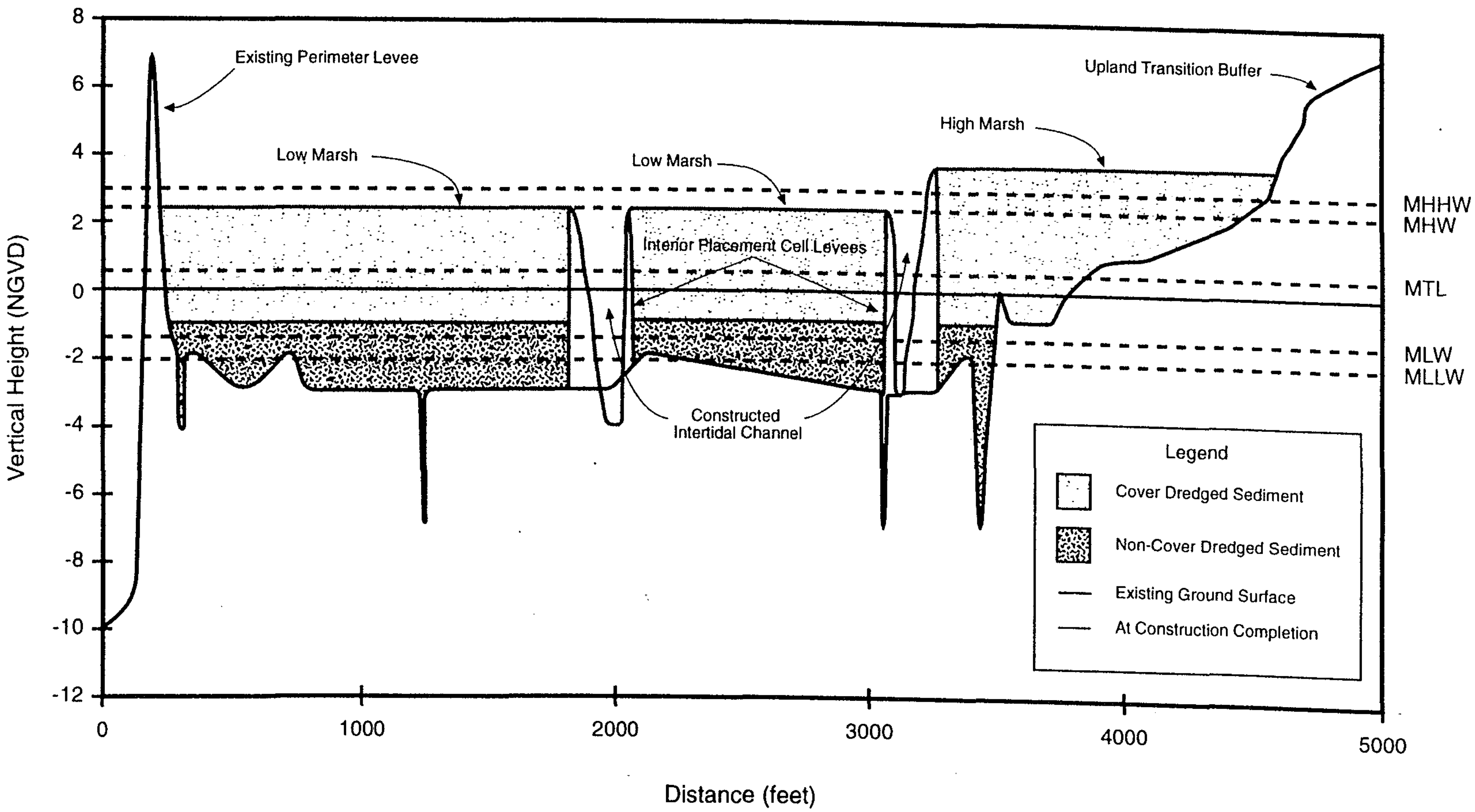
The construction and operation of the project facilities are part of the proposed action. These facilities include the off-loading and sediment distribution facilities, levees, access roads, channels, the drainage system, ancillary facilities, the rehandling facility, and public access facilities. These elements of the project are described below. Significant changes to the project design have been made since the DEIR/EIS to minimize the potential for exposure of contaminants, and to ensure that ecological objectives are achieved. These modifications to project design are summarized in Table 4.3-1 and described in more detail where applicable in the subsections that follow below.

Details of the evolution of the Project design in response to engineering and environmental concerns are contained within documents prepared by the applicant from 1992 through 1996. These documents are listed in Table 4.3-2. Project design modifications developed since the Public DEIR/EIS (October 1994) are presented within two documents prepared by the applicant: the *Ecological Resources Mitigation and Restoration Plan*, dated August 10, 1995 and the *Engineering Report*, dated August 14, 1995. The applicant also prepared a *Draft Monitoring Plan*, dated March 26, 1996 that provides additional detail regarding long-term Project monitoring and maintenance. The key Project design and monitoring aspects presented in those reports have been evaluated and form the basis of many of the mitigation measures presented within this FEIR/S.

4.3.1 Off-Loading and Sediment Distribution Facilities

An off-loading facility for dredged materials (refer to Figure 4.2-4) would be built on the southern end of the site in the Sacramento River. The off-loading facility would be a structure connected to the shoreline by a pedestrian access ramp. The facility would consist of two moveable end barges to hold the dredged sediment barges (the transport barges) in place. Transport barges would bring dredged materials to the site and would moor next to the two moveable barges.

To unload dredged materials, water would be pumped from on-site shallow groundwater wells and the water makeup pond into the moored transport barge. As the water mixes with dredged sediment, a "slurry" would be created. ("Slurry" is a mixture of dredged sediment and water consisting of, for this project, 15 to 25 percent solids.) This slurry would be sucked out of the transport barge through an off-loading suction pipe. An operator in the control room would control the suction pipe. The suction pipeline would connect to a 20-inch transport pipeline at the shoreline. The transport pipeline would be composed of the primary pipeline and secondary pipelines. A small walkway would connect the barge to shore (see pedestrian access ramp below).



TYPICAL LOW MARSH AND HIGH MARSH AS PROPOSED IN THE DRAFT EIR/EIS

Levine·Fricke·Recon
Project No. 2393

Figure 4.2-5a

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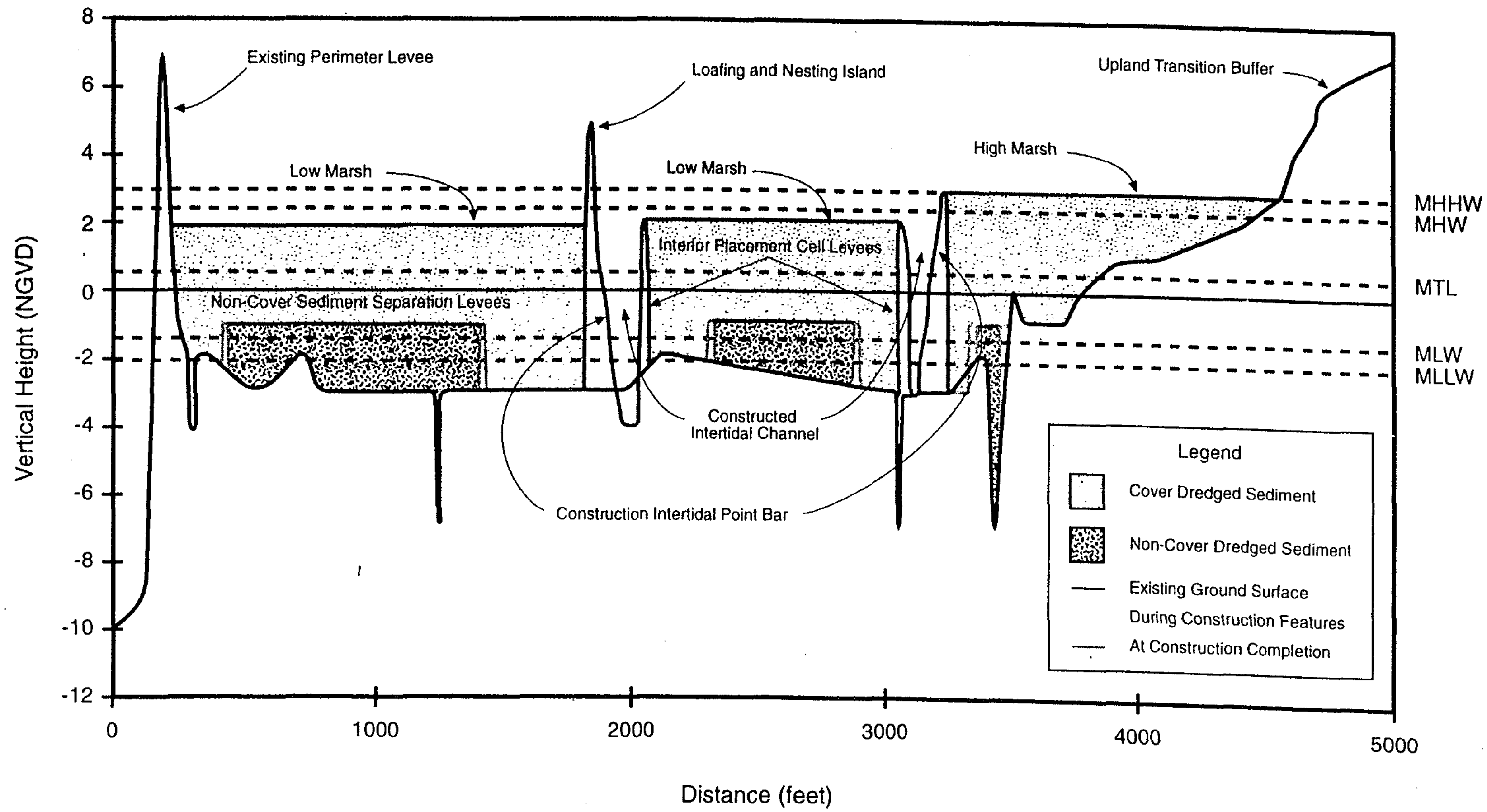

REVISED TYPICAL LOW MARSH AND HIGH MARSH

Levine·Fricke·Recon
Project No. 2393

Figure 4.2-5b

Table 4.3-1
Modifications to Project Design

Subject	*DEIR/S Design*	*Mitigated Design*
Ecological		
Low Marsh:	0.25'[1] below MHW 893 acres 49% of restoration area	0.5' below MHW 1,440 acres 79% of restoration area Channels increased by 75%
High Marsh:	0.75' above MHHW 810 acres 44% of restoration area	MHHW 145 acres 8% of restoration area
SMHM Habitat:	810 acres of high marsh	145 acres of high marsh 48 acres diked pickleweed marsh 47 acres in managed fluvial hollows
Intertidal Ponds:	20	2 ponds in Phase I
Seasonally Wet Depressions (formerly seasonal ponds)	70 acres	43 acres in upper high marsh edge 14 acres in managed fluvial hollows
Intertidal Point Bars (Fish)	None	13 acres
Engineering		
Noncover Sediment Placement:	3' below cover sediment 12' from larger channels	3' below cover sediment 200' from larger channels
Sediment Cell Levees	Interior cell levees surround noncover sediment and overlying cover sediment Geotextile fabrics in interior levee sidewall to filter decant	Noncover separation levees added to confine noncover sediment in cells 200' from channels Interior cell levees surround cover- only sediment, which surrounds non-cover cells Geotextile fabrics in noncover separation levee sidewall to filter decant
Cover Sediment Placement	Placed directly onto noncover sediment	Placed exterior to noncover separation levee and allowed to flow over noncover sediment
Water Handling Facilities	2 large make-up water ponds in use simultaneously	1 large make-up water pond in use 1 make-up water pond for backup only

1 All design elevations have a tolerance of +/- 0.5 foot

Table 4.3-2
LFR Technical Submittals in Support of the Montezuma Wetlands Project, 1991 - 1996

Date	Title
6/12/91	Preliminary Technical Report
10/2/91	Corps permit application submitted
10/11/91	Solano County General Plan amendments application submitted
5/1/92	Technical Report
8/11/92	Salinity Simulations Report
7/28/92 and 8/17/92	Addenda 1. Letters and drawings Sheets 1-4: Tidal wetlands preliminary grading plan (superseded by 3-11-93 SMHM Plan) Sheets 5-8: Tidal wetlands alternative, channel cross sections Sheet 9: Managed wetlands drainage structures Sheet 10: Layout of combined managed and tidal wetlands Sheet 11: Preliminary managed wetlands drainage ditch section Sheet 12: Access road Sheet 13: Return water channel during dredged sediment placement
1/4/93	Letter to USFWS re: Amphibian and Reptile Surveys
1/25/93	Letter to Solano County re: Response to information requests from Solano County Topics: wetland delineation, Phase I details, habitat, and vegetation targets, phasing and monitoring plan for SMHM, justification for size of off-loading area, adequate cover sediment supply, construction equipment
2/17/93	Dredged Sediment Rehandling Facility Report
2/26/93	Letter to Solano County, Corps, RWQCB RE: Response to information requests from county and Corps Topics: sediment texture, sediment quality, fill design elevations, channel design, levees, sediment cell preparation, water and salt budget, SMHM mitigation, evaluation criteria, engineering design for Phase I, habitat and vegetation targets, rehandling facility, adequate cover sediment supply, and construction equipment
2/26/93	Mass and Salinity Balance Report
3/11/93	Supplemental Geotechnical Analysis Report
3/11/93	Draft Salt Marsh Harvest Mouse Mitigation Plan
5/7/93	Letter to Solano County: summary of meetings with Phil Williams & Associates and William Lettis & Associates staff
5/25/93	Letter to Solano County summarizing levee burrow area information
6/24/93	Supplemental Rare Plant Survey Report
7/12/93	Preliminary Monitoring Plan for Settlement Monitoring and Levee Performance
7/28/93	Letter to Solano County: Preliminary Subdrain Plan for Phase I
8/5/93	Letter to Corps: revision to WRI acreage to reflect change for SMHM habitat
4/4/94	Letter to Corps: figures for Corps 404 Public Notice
6/15/94	Rooting Depth of Tidal Marsh Vegetation: A Brief Summary of the Literature, by Joshua N. Collins, Ph.D.
8/10/95	Ecological Resources Mitigation and Restoration Plan

Table 4.3-2
LFR Technical Submittals in Support of the Montezuma Wetlands Project, 1991 - 1996

8/11/95	Dredged Sediment Quality Report
8/14/95	Engineering Report
3/26/96	Draft Monitoring Plan
5/3/96	Letter to David Wright, USFWS, re: invertebrate sampling at Montezuma
5/15/96	Letter to SAIC, Corps re: results of aerial photo analysis
10/24/96	Letter to Corps, County, SAIC summarizing results of Spring/Summer 1996 ecological monitoring
10/28/96	Letter to Corps summarizing methods for monitoring and controlling dredged sediment elevations at the Montezuma site

As shown in Figure 4.2-3, the transport pipeline would extend up to 21,000 feet on the site to Phase III. Large concrete blocks, called thrust blocks, would be placed at locations where the pipeline turns abruptly. Secondary pipelines, also 20 inches in diameter, would convey the slurry material from the primary pipeline to the sediment cells. One or two booster pumps located along the pipeline would keep the slurry material moving through the pipelines.

Following completion of dredged materials deposition and wetlands restoration, off-loading facilities would be removed, unless there is a need to continue operations at the rehandling facility, described in section 4.3.6. A separate use permit would be required to continue operation of the rehandling facility after termination of the marsh restoration process.

Specific components of the off-loading facility are described below.

Off-Loading Barge

A 155-foot-long by 50-foot-wide off-loading barge would be anchored in place by two 100-foot-long by 50-foot-wide working barges which would also be secured parallel to the shoreline at the riverward end of the off-loading barge. There would be a control room on the offshore end of the off-loading barge. As shown in Figure 4.2-4, the off-loading barge would support the pumping and ancillary equipment. The working barges would support mooring or securing fixtures to accommodate the transport barges in various positions. No dredging is anticipated in order to construct this facility. A floating barge with pile driver and crane would be required to drive anchor piles during construction. The off-loading barge would then be sent to the site, positioned and secured in place to the anchor piles. Smaller work boats could be used to assist the operation and tend anchor lines for the floating barge.

Transport Barges

Transport barges (235 feet long by 53 feet wide with 18-foot draft) would bring dredged materials to the site and moor adjacent to the working barges. One transport barge can accommodate up to 4,000 cubic yards of dredged materials. When the transport barge is docked, facilities would extend about 235 feet from the shoreline into the river.

Dredged materials would be removed from the transport barges using 1,500 hp diesel-powered pumps at the off-loading facility. A suction pipe would be supported over the barges by a mast arm or boom and Aframe or other type of support system located on the working barge. Prefabricated structural support members would be transported to the site and assembled on the working barge. The suction pipe support structure would be attached to the barge structural framework and rise 72 feet above the deck of the barge.

Pedestrian Access Ramp

An approximately 130-foot-long by 4-foot-wide pedestrian access ramp would be built from the existing levee to the off-loading barge, which would be secured perpendicular to the shoreline on the Sacramento River. The pedestrian access ramp could be a prefabricated ramp, fixed at the shore on a landing. The other end would be supported on the off-loading barge deck, moving up and down with the tides.

Control Room

A control room would be located near the suction pipe to oversee the off-loading operation. The control room would house control equipment for the pumps and mast arm/suction line. The room would be elevated above the working barge deck so that the operator is able to view the transport barge as pumping occurs. Prefabricated tower supports for the control room would be transported to the site and erected onto the working barge deck. A prefabricated control room would then be placed atop the support structure. The pumps and pipelines on the barge would be located on the deck. Where the pipeline crosses from the barge to the shore, a flexible floating line would be used.

Primary Pipeline

A 20-inch diameter high density polyethylene pipeline would be placed between the off-loading facility and the proposed marsh restoration sites to carry slurry to those sites. The primary pipeline would be approximately 17,000 feet long when extended to the Phase I marsh creation area, and would extend another 4,000 feet for a total of 21,000 to reach Phase III, the furthest pumping distance. Trench excavation would be required to place the pipeline under Fire Truck Road.

The primary pipeline would be placed west of the railroad trestle south of Fire Truck Road as shown in Figure 4.2-3. The pipeline would be placed on the ground surface where possible. In some locations, wooden pipeline supports would support the pipe and allow small mammal passage. This pipeline would remain in place for all phases of the project.

Large concrete blocks, called thrust blocks, would be placed at locations where the pipeline turns abruptly. One would be located 5,000 feet north of Fire Truck Road. Two others would be located 100 feet south of Fire Truck Road. The thrust blocks would require several cubic yards of concrete each and would be 7 feet by 7 feet wide.

One or two 1,500 horsepower mobile diesel powered booster pumps with anchors would be placed at locations along the primary pipeline to keep the dredged materials slurry moving through the pipeline. One pump would be located 3,200 feet north of Fire Truck Road, west of the railroad trestle. Another would be 1,800 feet south of Fire Truck Road about midway between Collinsville Road and the Montezuma Slough levee.

Secondary Pipelines

Secondary pipelines, which would also be 20 inches in diameter, would convey the material from the primary pipeline to the selected placement cells. Secondary pipelines would be placed under the railroad trestle. Secondary pipelines would be removed after each cell is completed, but are likely to be in place for 1 to 4 years.

4.3.2 Levees

There are 4 types of levees associated with the revised project design, as shown in Figure 4.2-1. The site is separated from the Sacramento River and Montezuma Slough by an existing "perimeter levee." Within the interior of the site, the four phases of the project would be separated from each other, the DWR day use area, and the offloading-rehandling facility, by "phase levees." Within each phase, cover sediments would be placed within cells delimited by "interior cell levees," which would also form the banks of constructed channels. Within some of these cells, non-cover sediments would be placed and confined within "non-cover separation levees" which would be set back 200 feet from the interior cell levees and surrounded (as well as overlaid) by cover sediment. The inclusion of non-cover separation levees and the 200-foot setback are important revisions to the project design that increase the isolation of non-cover sediment (compare Figures 4.3.2-1a and 4.3.2-1b).

The exact locations of the phase levees and cell levees would be determined in the field after producing soil borings are taken. Levees would be placed to follow higher elevations on the site, and in locations that have thick compressible soils. Figure 4.3.2-2 provides a typical schematic; additional description of each type of levee follows below.

4.3.2.1 Perimeter Levee Repair

The existing levee that separates the site from the Intertidal waters of Suisan Bay and Montezuma Slough defines the project perimeter levee. The project includes the repair and maintenance of this levee during project construction. Repair of these existing levees around the perimeter of the site would include placement of aggregate rock for readable on the crest of the levee to allow for vehicle access during sediment placement, widening of certain levees to provide adequate roadway widths, and regarding uneven areas to create a smooth surface. Any widening would occur internal to the site and not into the adjacent waterway.

Each of the four phases of the project would be connected to a tidal source through a breach in the perimeter levee. Once tidal circulation is reestablished, maintenance of the perimeter levee would cease.

4.3.2.2 Phase Levees

Phase levees would be constructed to separate the four phases of the project, provide containment of dredged sediment, and provide vehicle access to the four phase areas for maintenance and monitoring. The following levees would be constructed at the locations shown in Figure 4.2-1:

- Separating Phase I from Phase III north of Fire Truck Road;
- Along the western boundary of Phase III at the north end of the site;
- Separating Phase II from Phase IV south of Fire Truck Road; and
- Separating Phase IV from the Water-Related Industry (WRI) area near the offloading facility.

Fire Truck Road would provide separation between Phases I and II.

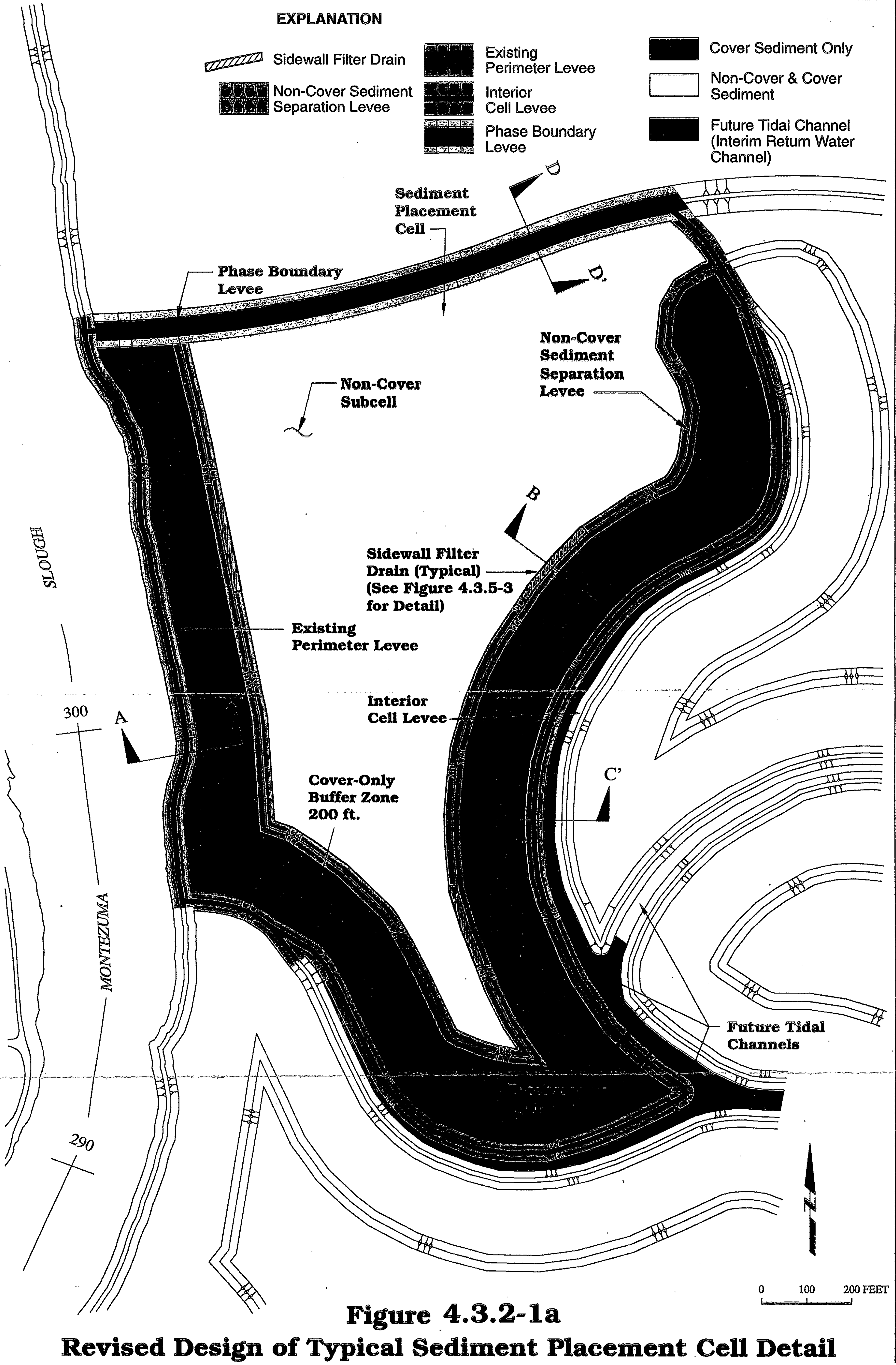

Figure 4.3.2-1a
Revised Design of Typical Sediment Placement Cell Detail
Montezuma Wetlands Project

Levine·Fricke·Recon

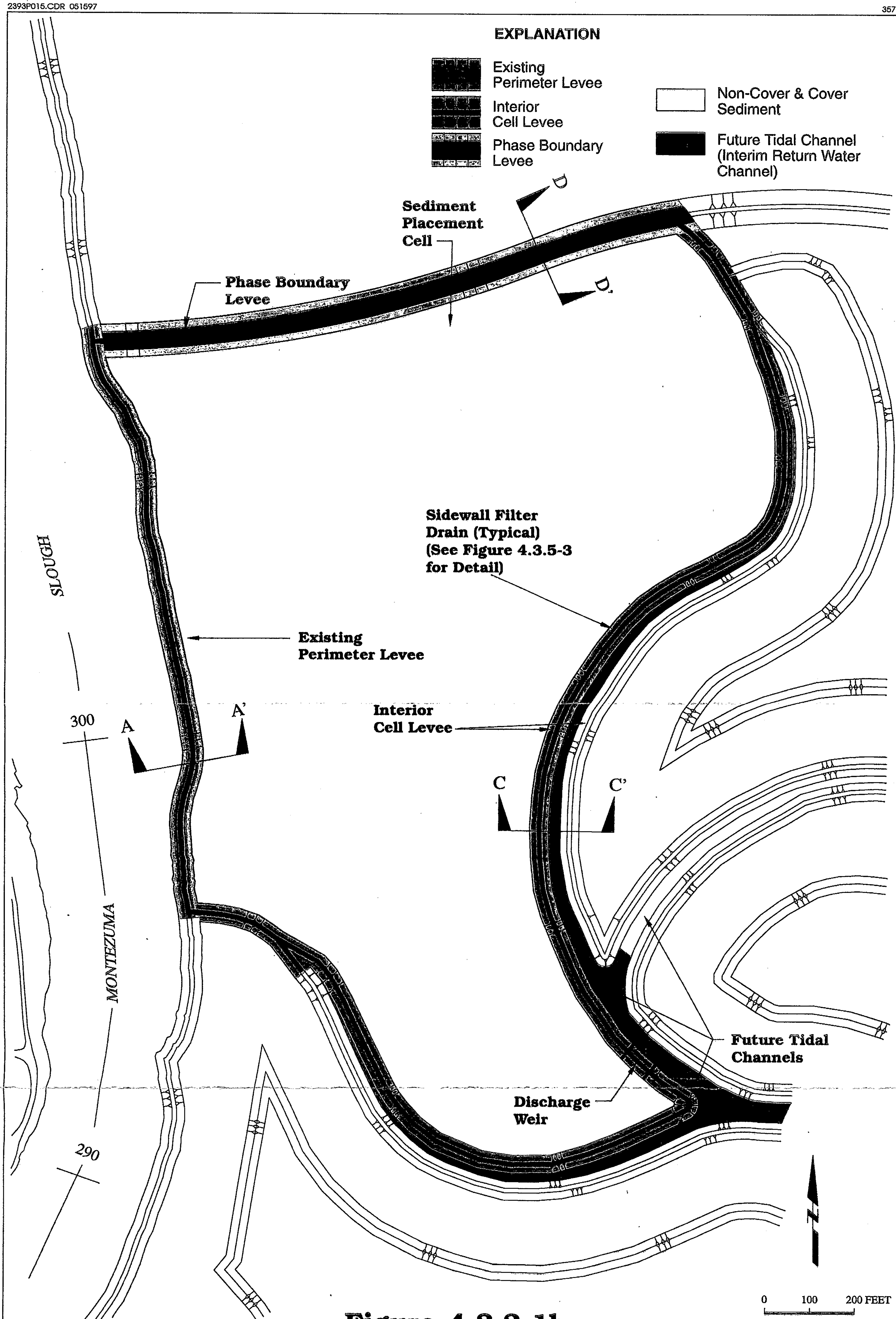

Figure 4.3.2-1b

Typical Sediment Placement Cell Detail at Time of Draft EIR/EIS Montezuma Wetlands Project

LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

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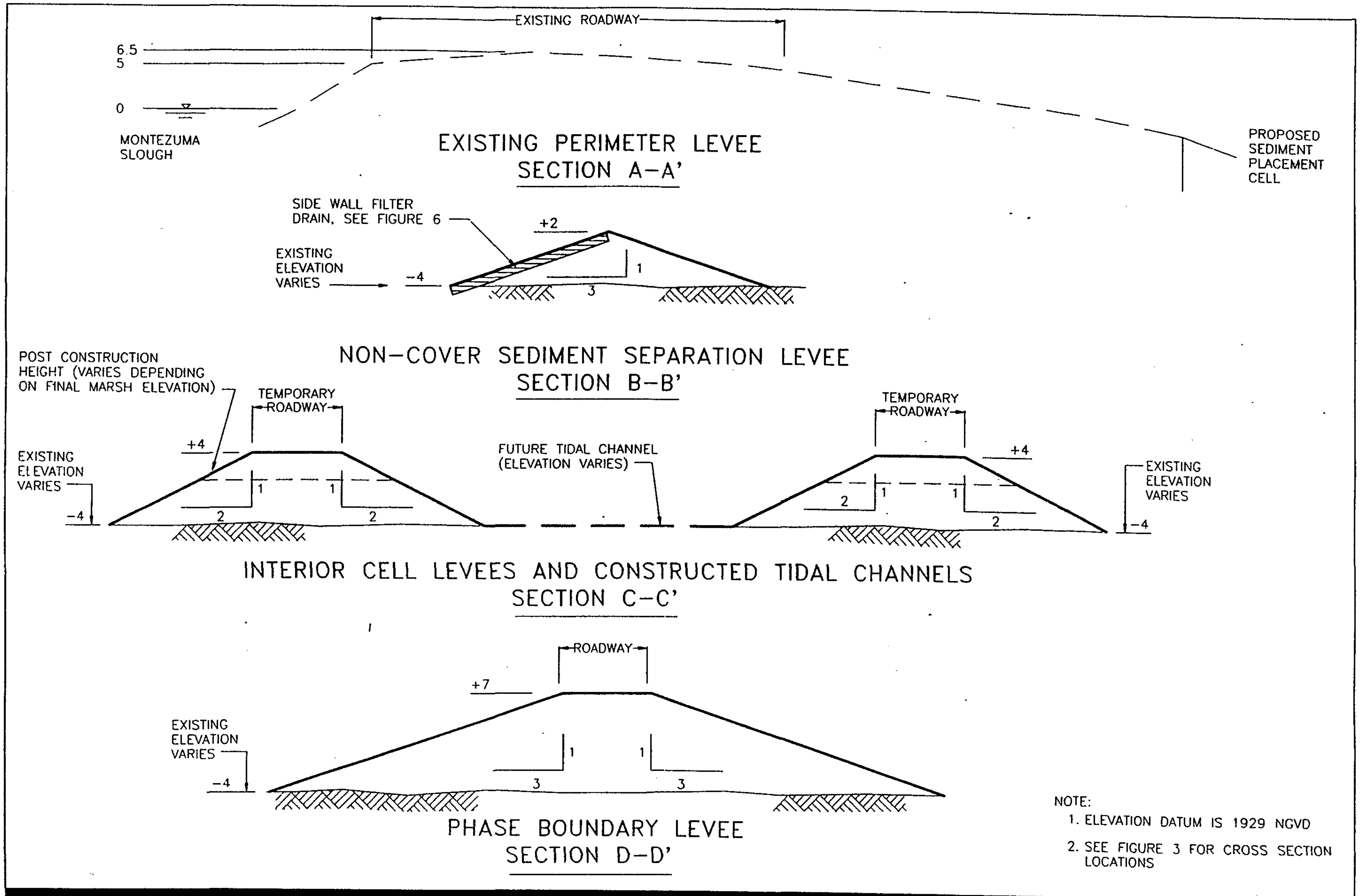

Source: Levine-Fricke (1995c)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.3.2-2

Cross Sections of Levees

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Prior to levee construction, the footprint of the levee would be cleared of abandoned structures, excavated, and stripped of vegetation. In soft areas, only clearing would be performed. After any material unsuitable for levee foundation has been removed, the levee footprint would be prepared for fill by excavating the ground to a depth of 6 inches and compacting the area.

Phase levees would be used as primary access routes and would be engineered to support vehicle loads. These levees would provide the primary access routes through the site during project construction and monitoring and would be connected to the perimeter levees. The western Phase III boundary levee is also intended to provide flood protection for areas immediately north and east of the project boundary.

Preliminary Geotechnical studies prepared by the Project Applicant indicate that the use of Geotextile may be necessary to enhance foundation stability. Geotextile would be anchored in place prior to placement of levee material.

The phase levees would be built up to, and maintained at, an elevation of approximately +7 feet NGVD[2] and have a crest width of 12 feet, with 2:1 side slopes. Turnaround areas on the levees would generally be constructed every 1,500 feet.

Material for levee construction and maintenance would originate from borrow areas within the project boundary. Borrow sites will be located within each phase, within the area of planned wetland construction. Dried dredged sediments from the rehandling facility would also be used if on-site material is insufficient. Specific selection of material would be made at the time of construction following site-specific soil property tests.

Trucks with a capacity of 10 cubic yards of material would be used to transport material to the work areas. Track-mounted cranes or bulldozers would then construct the levees, using mats underneath the bulldozers if the existing soils are not capable of supporting the ground load of the equipment. Levees would be constructed in layers, known as "lifts," to minimize potential stability problems.

The levees would be built using staged construction, so that the potential for stability problems is reduced. In areas where existing soils contain peat or other compressible soil, the phase boundary levees could be constructed using geotextiles placed at the levee base to increase bearing capacity.

4.3.2.3 Interior Cell Levees

Refer to figures 4.3.2-1a and 4.3.2-2 for depiction of interior cell levees and their distinction from non-cover sediment separation levees. Interior cell levees would be constructed to provide containment of the dredged sediment within each sediment placement cell. These placement cells would function as the settling basins for the dredged sediment pumped from the barges; placement cells would be designed to handle either cover sediment only or both cover and non-cover sediment (see section 2.3). The cell levees would be constructed around 30- to 200-acre areas within each phase. The cell levees would be maintained at a height of approximately 2 feet above the dredged materials for the duration of sediment placement activities. Upon completion of sediment placement, these interior cell levees would be lowered to the level of the restored marsh except in areas that will become nesting and loafing islands (see section 4.4.9). Exact alignment of the cell levees will be determined during final design (i.e., during preparation of plans

2 National geodetic vertical datum, similar to mean sea level.

and specifications). Crest widths would vary from a minimum of 5 feet to 12 feet where vehicle access is required.

The slopes of the interior cell levees will range from 2:1 to 5:1, final designs being determined on the basis of engineering properties of the material and the forces of potential erosion and deformation to which it will be exposed. Where levee slopes extend above the adjacent marsh plain or are used to form constructed channels (see below), native marsh vegetation will be established to stabilize them prior to tidal restoration. Constructed channels, which would become the intertidal marsh channels after construction is completed and each phase is opened to tidal action, would be delimited by pairs of parallel interior cell levees and will have side slopes ranging from 2:1 to 5:1, depending on calculated shear forces.

Cell levees would be widened at locations where the cell waters discharge over weirs to ditches, which would drain to the makeup water pond. (For this project, "makeup water" is water that would be pumped from shallow groundwater wells to slurry the dredged sediment.). See section 4.6.3 for a more detailed description of the Project's water management system.

Overflow drainage weirs would be installed at the interior levee discharge points to allow for gravity drainage or pumping of surface water from the cover-only sediment areas into the return water flow channel which will gravity flow back to the make-up water pond.

Interior cell levees will in most locations be graded down to marsh plain elevations (see section 4.4.9 for exceptions) prior to the introduction of tidal circulation.

4.3.2.4 Non-Cover Sediment Separation Levees

This design feature has been added since the Draft EIR/EIS, in order to minimize the potential for exposure of contaminants. These levees would be constructed to keep the non-cover dredged sediment 200 lateral feet from the larger intertidal marsh channels, to prevent channel incision into non-cover material due to channel migration. These levees would be constructed high enough to provide sufficient freeboard to contain approximately 2 feet of ponded water during placement of dredged sediment. Sidewall filter fabric would be installed at drainage points in these levees to remove suspended sediment from the discharge water before the water is pumped back into the return water flow channel. A minimum of 18 inches of drainage rock would be placed around the discharge pipes to allow natural filtration and leaching to minimize the size of pipe within the levee.

After placement of the non-cover sediment is completed, these internal levees would be lowered in several locations to allow for placement of the cover sediment. Lowering these levees will allow the cover sediment (placed outside the non-cover levees) to flow over the non-cover sediment to achieve the required 3-foot minimum depth of cover over the non-cover sediment. This approach will allow for sands to settle out in cover-only cells and for the finer-grained sediments to cover the non-cover sediment. The discharge pipe that places dredged cover sediment would never be directly in contact with non-cover sediment; this will reduce turbulence and avoid the mixing of cover and non-cover sediment during placement. The sediment disposal pipe would be relocated during the fill of each cell to compensate for differences in settling rates between clays, silts, and sand.

4.3.3 Sediment Placement Cells

A detail of the revised design for sediment placement cells was provided in Figure 4.3.2-1a, with Figure 4.3.2-1b showing the previous design for comparison. The revised design increases the insolation of non-cover sediment, as discussed below. These cells will function as the settling basins for the dredged sediment pumped from the barges. Dredged sediment will be placed to allow sloping of the sediment toward the constructed marsh channels. Placement cells will be designed to handle either cover sediment only or both cover and noncover sediment. Decant water from these cells will be drained as described in section 4.3.5.2.

4.3.3.1 Placement Cells for Cover Only Sediment

These cells will be delimited by interior cell levees, as described in section 4.3.2.3. Cover sediment will be placed in these cells as described in section 4.3.1.

4.3.3.2 Placement Cells for Cover and Non-Cover Sediment

Placement cells that contain noncover sediment will have additional internal non-cover sediment separation levees to isolate non-cover sediment laterally from constructed tidal channels (see section 4.3.2.4).

Placement of non-cover sediment would not occur until sufficient cover sediment is known to be available to place over the non-cover sediment within 6 months of placing the non-cover sediment. During this period, standing water would be maintained over the non-cover sediment to prevent drying of this sediment and to limit exposure of the sediment to biota.

Cover sediment only would fill up the outer area (between the non-cover sediment separation levee and the interior cell levee; see Figure 4.3.2-1a) and then flow through breaches in the non-cover separation levee and over the settled non-cover sediment, in order to minimize stirring or mixing of cover and non-cover sediment and to maximize the percentage of fine-grained sediment covering non-cover sediment.

4.3.4 Channels

Each phase would include a hierarchy of channels through which the tide would flow. Channels would vary in size, length, and depth with the higher order (bigger) channels at the tidal inlets changing to lower order (smaller) channels moving upgradient in the marsh. In the revised project design, the configuration of channels follows Corps of Engineers guidelines,[3] and channel widths and cross-sectional areas, originally based on the Petaluma Marsh Model,[4] have been increased by 75 percent. The latter was recommended in the Public Draft EIR/S as a mitigation measure to reduce the erosive potential of tidal currents. The preliminary channel designs for phases I and II of the project are described in Table 4.3-3 with channels as shown in Figures 4.3.4-1a and b.

Channel designs for each phase would be finalized and submitted to the County and Corps for approval prior to the agencies' authorization of construction for each phase. This would enable channel designs to be integrated with cell dimensions and landscape elements, which are subject to modification based on mitigation or permitting requirements. This approach would contribute to the "adaptive management" of

3 Coats et al. 1995

4 Part of Levine-Fricke 1992; included as Appendix A in Volume II of this Final EIR/EIS.

the project, allowing data from earlier phases to be considered in the design of subsequent phases. Finalized channel designs would also take into account additional data (to be collected by the Applicant) on the hydraulic geometry relationships of tidal channels in Suisun Bay marshes.

The larger channels, delimited by interior cell levees, would be built before dredged sediments are placed, while the medium and small channels would be excavated (in cover sediment cells only) after each cell's sediments are placed and drained. The smallest channels are designed to be formed as the result of tidal flow within the cells. There would be five different sizes of channels, varying in depth from 4.2 to 7.4 feet and varying in surface width (at MHHW) from 21 to 61 feet (see section 4.4.1 for more detail on the different orders of channels). Each phase of the project would have similar channels. Channel excavation would not proceed until the sediments are sufficiently drained so that the design specifications for channel form can be achieved. Some occasional sloughing (crumbling) of channel banks would be expected. To minimize sloughing, tributary channels would be widened (or "flared") at their confluence with larger channels. The channels would be expected to shoal and narrow slightly as the marshland matures.

4.3.5 Drainage Systems

The project includes two main drainage systems: a subdrain system to dewater the on-site peat soils and a system to drain excess decant water from the dredged sediment.

4.3.5.1 Subdrain System

Much of the site is underlain by peat soils, which would compress when dredged materials are deposited over them, making it difficult to predict final elevations. To remedy this problem, where needed, a system of subdrains would dewater peat soils and induce more rapid settlement, increasing predictability of the final elevations and stabilizing levee construction areas. These subdrains consist of gravel lined trenches which will be constructed in existing peat soils prior to dredged sediment placement. This system would drain shallow brackish groundwater from underlying soils during cell construction and placement of dredged materials. The general areas where subdrains would be installed on the site are shown in Figure 4.3.5-1. The subdrain system is shown in Figures 4.3.5-2 and 4.3.5-3. This subdrain system is separate from the drainage system that would be used to draw excess water from the dredged sediments (as described in the following section), although the water from both systems would flow toward the same collection point, the makeup water pond.

The subdrain system would be installed (in conjunction with the construction of sediment placement cells) within the upper layer of existing high peat-content soils to dewater and pre-settle the peat. This dewatering system would begin operation before sediment placement and is not the same as the sidewall dewatering system used in the non-cover separation cell levees.

The subdrain system would be constructed in the existing peaty soils using a trenching machine. The trenches would be 1 foot wide and 5.5 to 7.5 feet deep. The ditches would be approximately 100 feet apart. Individual trench lengths would be on the order of 300 to 400 feet, but would vary depending on the size and shape of the area to be drained. Washed gravel and a geotextile fabric, or permeable material consisting of sand and gravel, would be placed to within 12 inches of the ground surface. A cap of clayey native soil would be placed above the drain material to seal the trenches. Shallow brackish groundwater will seep into the trenches and will be pumped out into the return water channel for delivery into the makeup water pond.

Table 4.3-3
Tidal Channel Advanced Conceptual Design Spreadsheet
Montezuma Wetlands Project

Channel Order	Basin Size (acres)	Average Basin Elev (ft NGVD)	Tidal Datum (ft NGVD) MHHW	MHW	MLW	MLLW	Surface Tidal Prism (ac-ft)	Preliminary Design XS Area (sq-ft)	Preliminary Design MHHW Width (ft)	Final Design (2:1 Channel Side Slopes) MHHW Width (ft)	Mean Width (ft)	Bottom Width (ft)	MHHW Depth (ft)	XS Area (sq-ft)	Invert (ft NGVD)	Mean W:D
Phase I																
Breach	540	1.9	2.90	2.41	-1.45	-2.08	606	**777**	129	129	107	85	7.3	**784**	-4.4	14.7
Clank Hollow	29	na	2.90	2.41	-1.45	-2.08	66	**215**	43	43	37	31	5.9	**217**	-3.0	6.2
I-A	41	1.9	2.90	2.41	-1.45	-2.08	41	**163**	34	34	28	22	5.9	**164**	-3.0	4.7
I-B	31	1.9	2.90	2.41	-1.45	-2.08	31	**139**	29	29	23	17	6.0	**139**	-3.1	3.9
I-C	32	1.9	2.90	2.41	-1.45	-2.08	32	**141**	30	30	24	18	6.0	**142**	-3.1	3.9
I-D	135	1.9	2.90	2.41	-1.45	-2.08	135	**325**	61	61	55	49	5.9	**325**	-3.0	9.3
I-D-1	14	1.9	2.90	2.41	-1.45	-2.08	14	**87**	20	21	15	10	5.7	**87**	-2.8	2.7
I-D-2	100	1.9	2.90	2.41	-1.45	-2.08	100	**273**	53	53	47	41	5.8	**274**	-2.9	8.1
I-D-2-a	29	1.9	2.90	2.41	-1.45	-2.08	29	**133**	28	29	23	18	5.7	**133**	-2.8	4.1
I-D-2-b	35	1.9	2.90	2.41	-1.45	-2.08	35	**149**	31	32	26	21	5.7	**150**	-2.8	4.6
I-E	135	1.9	2.90	2.41	-1.45	-2.08	135	**326**	61	61	55	49	5.9	**326**	-3.0	9.4
I-E-1	33	1.9	2.90	2.41	-1.45	-2.08	33	**145**	30	31	25	19	5.8	**146**	-2.9	4.3
I-E-2	91	1.9	2.90	2.41	-1.45	-2.08	91	**259**	50	51	45	39	5.8	**262**	-2.9	7.8
I-E-2-a	48	1.9	2.90	2.41	-1.45	-2.08	48	**179**	36	38	32	27	5.6	**181**	-2.7	5.8
I-E-2-b	40	1.9	2.90	2.41	-1.45	-2.08	40	**161**	33	35	30	24	5.5	**162**	-2.6	5.4
Phase II																
Breach	390	1.8	2.79	2.32	-1.43	-2.06	386	**598**	103	103	81	59	7.4	**599**	-4.6	10.9
II-A	29	1.8	2.79	2.32	-1.43	-2.06	29	**114**	28	34	24	15	4.7	**114**	-1.9	5.2
II-B	94	1.8	2.79	2.32	-1.43	-2.06	93	**225**	51	61	52	43	4.4	**229**	-1.6	11.8
II-B-1	42	1.8	2.79	2.32	-1.43	-2.06	42	**141**	34	42	34	26	4.2	**142**	-1.4	8.1
II-B-2	40	1.8	2.79	2.32	-1.43	-2.06	40	**137**	33	41	33	24	4.2	**138**	-1.4	7.8
II-C	29	1.8	2.79	2.32	-1.43	-2.06	29	**114**	28	34	24	15	4.7	**114**	-1.9	5.2

Notes:

1 Basic of Design Parameters: Collins (1991) and Levine-Fricke (1992), adjusting +75% cross section and width.
2 The design parameters will be confirmed for final design with additional field data from Suisun Bay tidal marshes.
3 Channel locations shown in Figures 4.3.4-1a and 4.3.4-1b for phases I and II, respectively.

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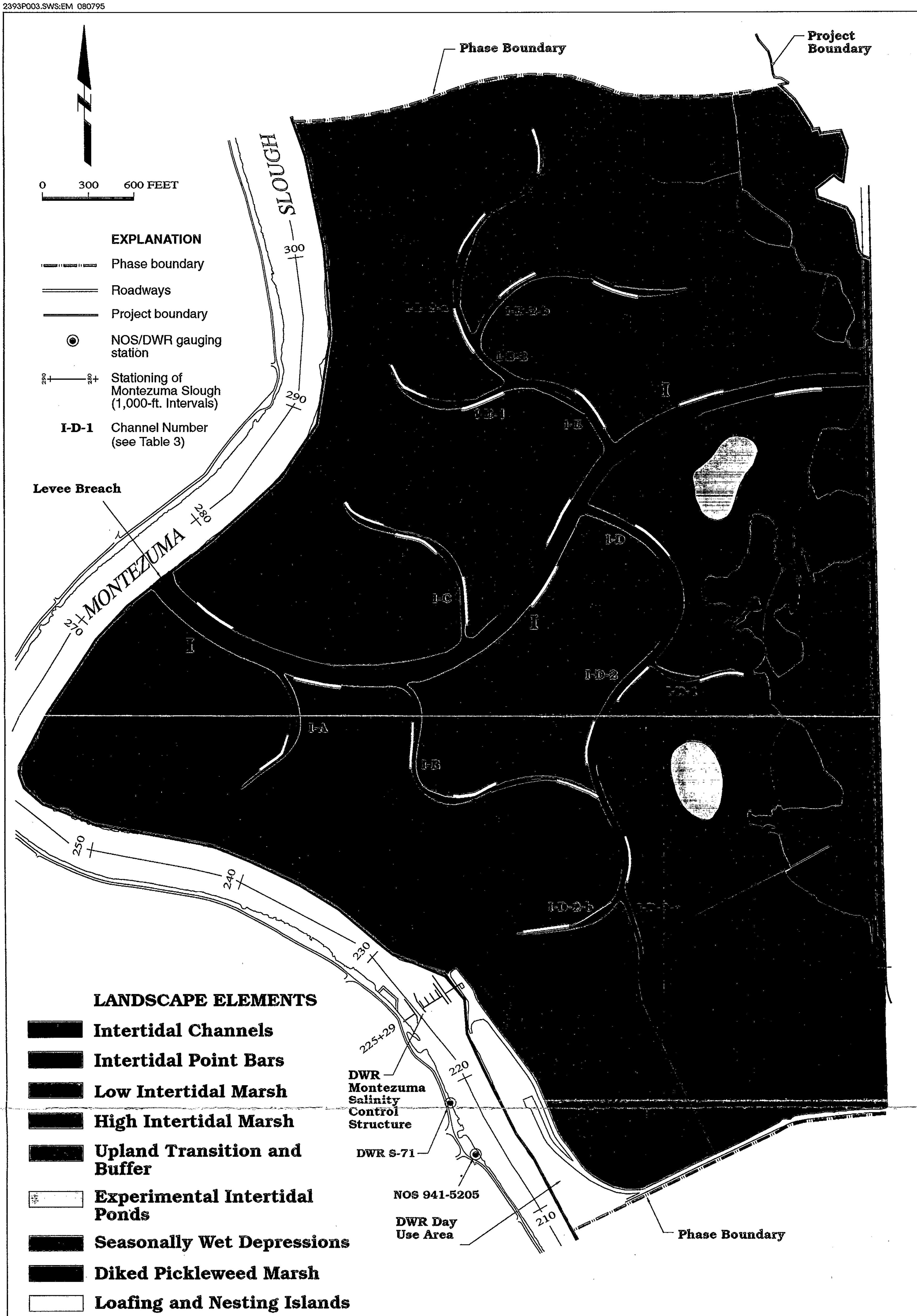

Figure 4.3.4-1a
Phase I Detail at Construction Completion

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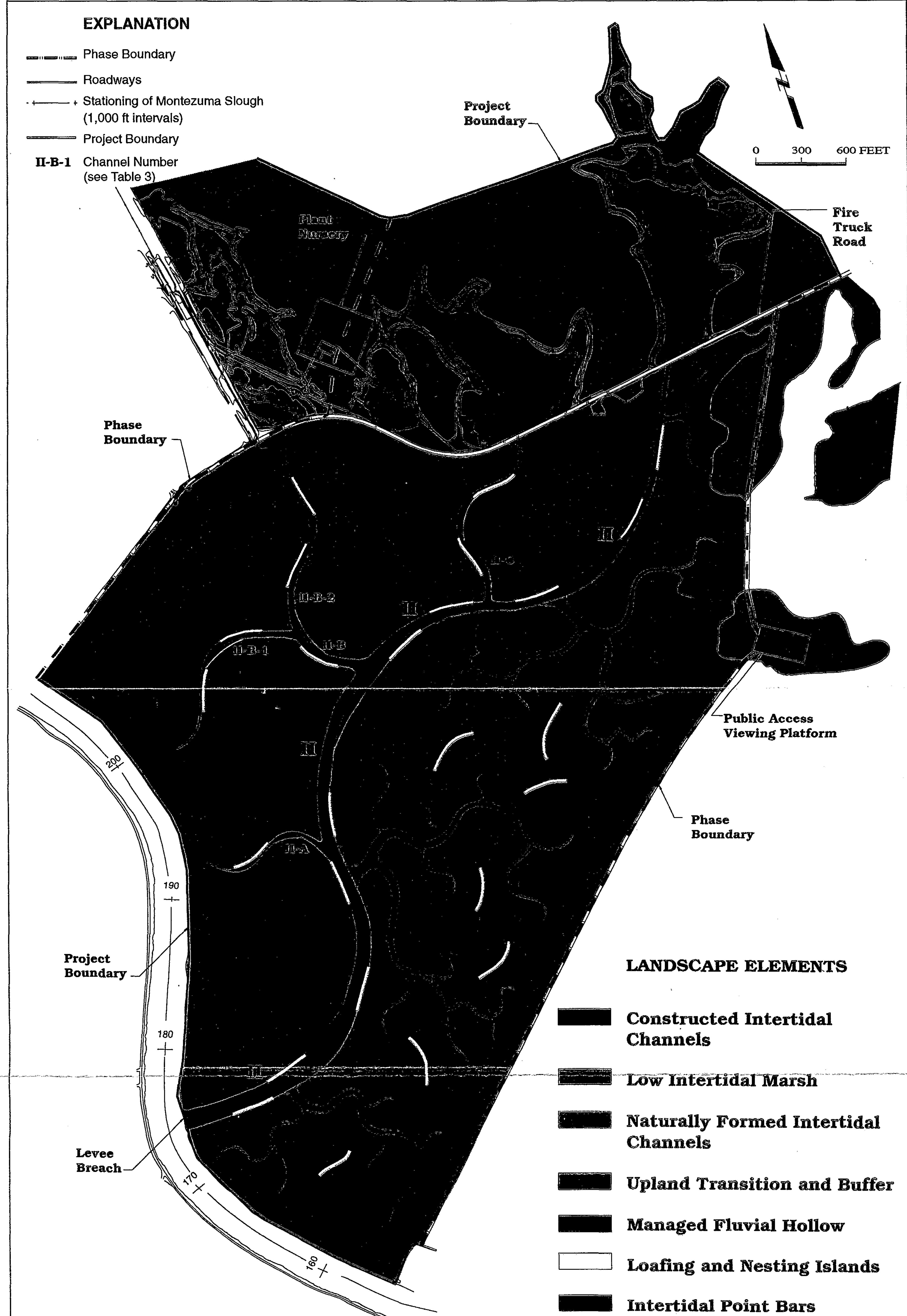

Figure 4.3.4-1b
Phase II Detail at Construction Completion

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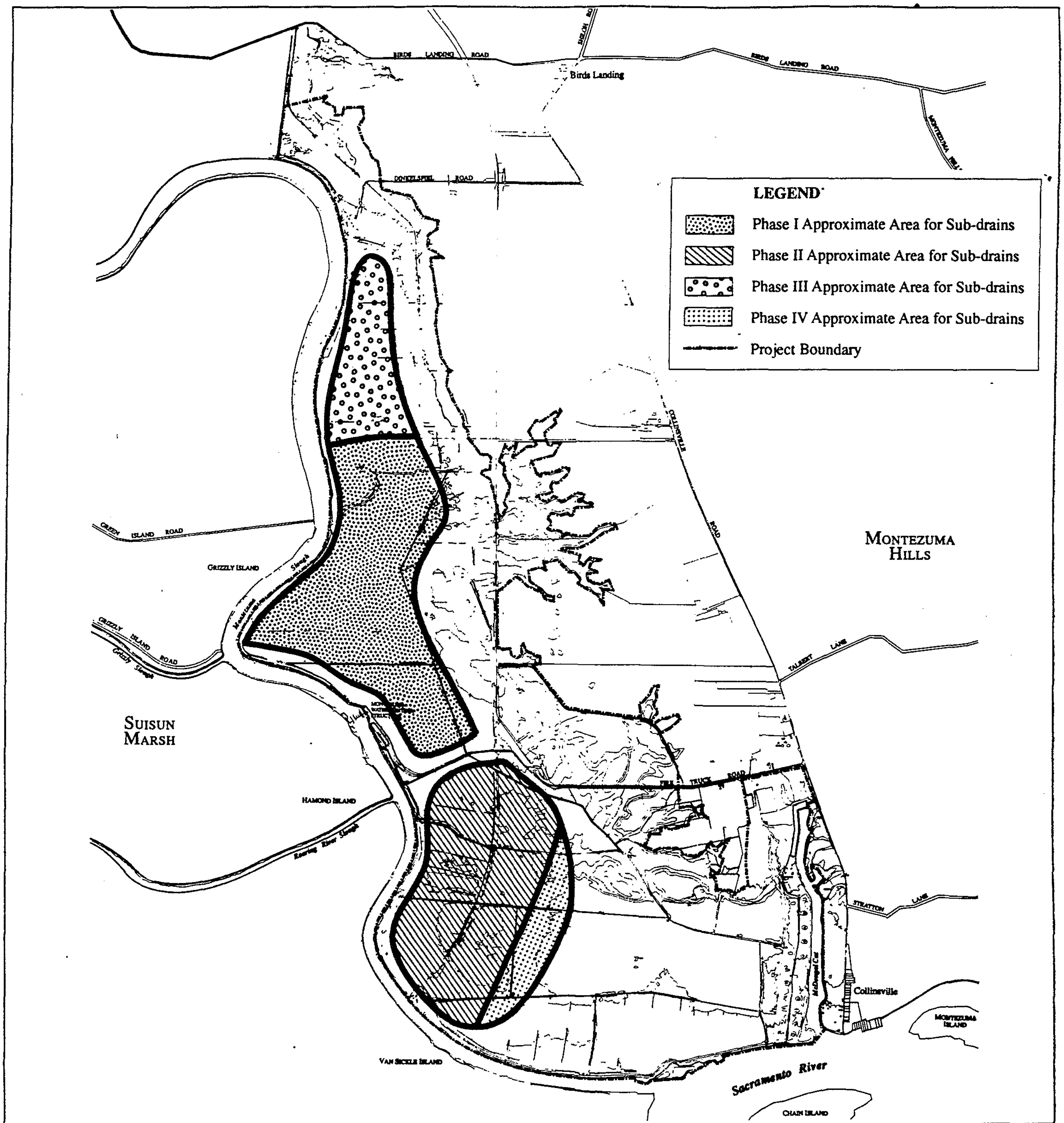

Source: Brady and Associates (1994)

MONTEZUMA WETLANDS PROJECT
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Figure 4.3.5-1

Proposed Project: Approximate Area for Subdrains

0' 1500' 3000' 6000'

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Bulldozers and backhoes would be used to construct these ditches, unless they become mired in wet soils; then crawler-mounted cranes with clamshell buckets would be used. Placement of rock fill in the ditches would be accomplished with the same equipment used during excavation construction. Materials would be transported to the work area with trucks outfitted with low-pressure tires to minimize haul road construction and maintenance. The thickness of peat and organic soils generally increases in the direction of Montezuma Slough. Consequently, the trench system would be laid out to take advantage of the expected settlement patterns to maintain drainage in the trenches. Given the expected lengths of individual trenches and relatively flat grades at the site, multiple collection trenches and/or discharge points would be required to maintain reasonable trench depths across the site. Trenches would be constructed with the minimum grades necessary to maintain system operation and to maintain reasonable excavation depths.

Modeling results indicate that it would take approximately 6 months to lower the groundwater level at least two feet beneath the sediment placement cells.[5] The anticipated average flow rate for the subdrain system would be approximately 50 to 60 gallons per minute (gpm).

When the final fill elevation is approached, pumping from the subdrains would be turned off. This would allow buoyancy conditions to re-establish in the underlying peat. Once buoyancy occurs, stresses in the compressible soils would be reduced below the pre-settled stresses, the settlement in the peat soils should then cease, and minimal additional settlement should occur.

4.3.5.2 Drainage of Decant Water

This drainage system would remove excess decant water from the dredged material slurry as the sediment settles. After settling, the clarified water from cover only sediment cells would be discharged over weirs into a sump and either pumped or gravity fed into the return water channel and ultimately back into the makeup water pond (refer to Figure 4.3.5-2. This decant water would reach the return water channel by flowing through the constructed marsh channels.

Decant water from placement cells that contain non-cover sediment would be managed differently, to minimize the potential for migration of non-cover sediment into the makeup water pond. Decant water from non-cover cells would be discharged through geotextile fabrics (placed against the sidewalls of non-cover separation cell levees), as shown in Figure 4.3.5-3. Geotextiles would screen sediments from this water, which would then flow by gravity through ditches to the makeup water pond.

The decant water would be recycled on site; some portion of it would eventually be discharged through a pipe (18 to 24 inches feet in diameter and less than 100 feet in length) into the deep waters of the Sacramento River. For additional detail on water use, see section 4.6.3 below.

4.3.6 Sediment Rehandling Facility

Jerico Towing Company currently operates an oyster shell rehandling facility at the northern end of McDougal Cut, on its western shore. The existing rehandling facility occupies approximately 69 acres, and consists of an area for stockpiling dredged sand and oyster shells, a barn, six concrete silos (approximately 40 feet high), and several small buildings, two floating docks, and a conveyor belt used for off-loading barges. Jerico Towing Company currently has a month-to-month lease with the Project

5 McDonald, M.G. and A.W. Harbaugh. 1984. A Modular Three-Dimensional Finite-Difference Groundwater Flow Model. USGS Open File Report 83-875.

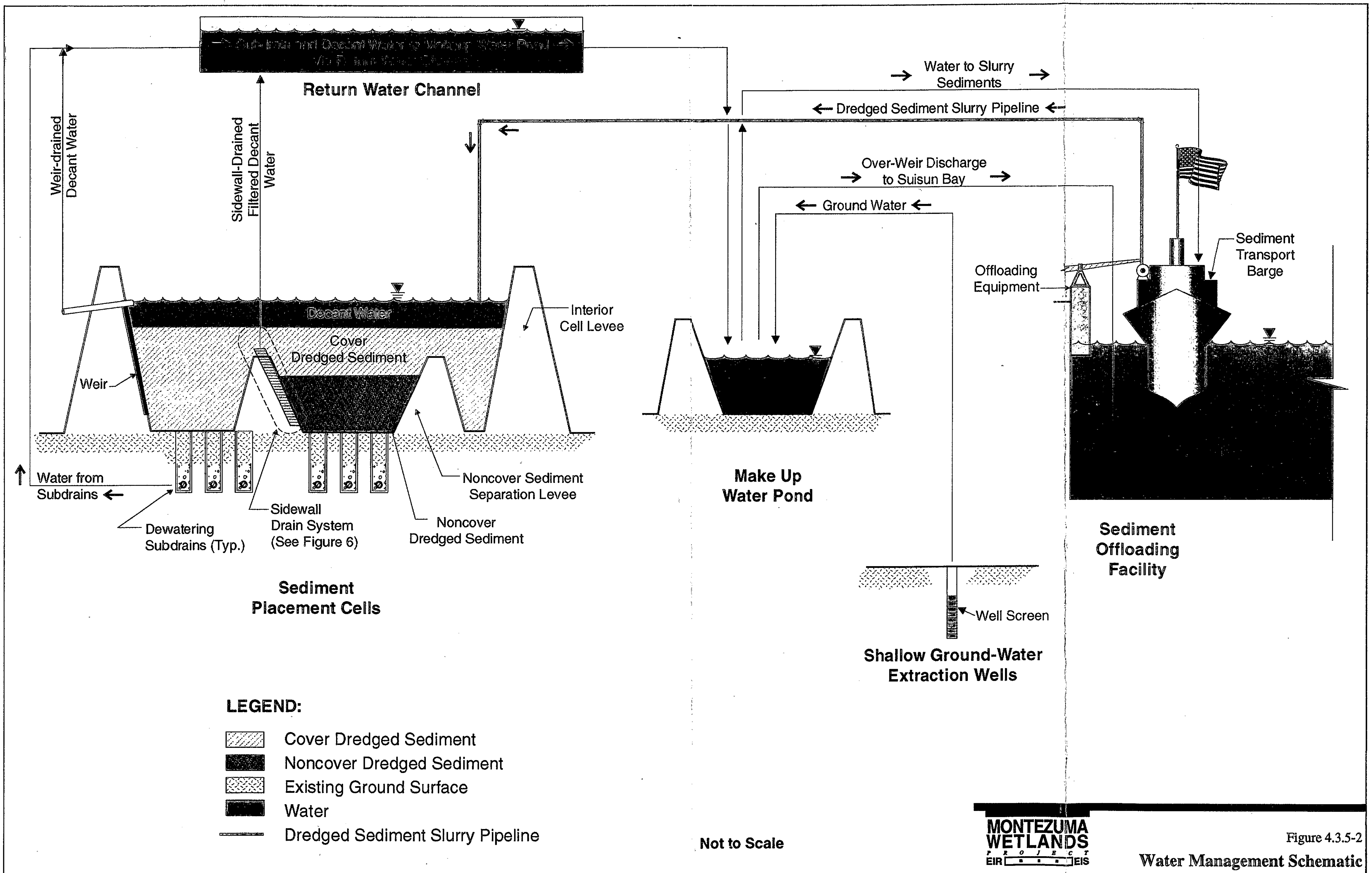

Figure 4.3.5-2
Water Management Schematic

Source: Levine-Fricke (1995c)

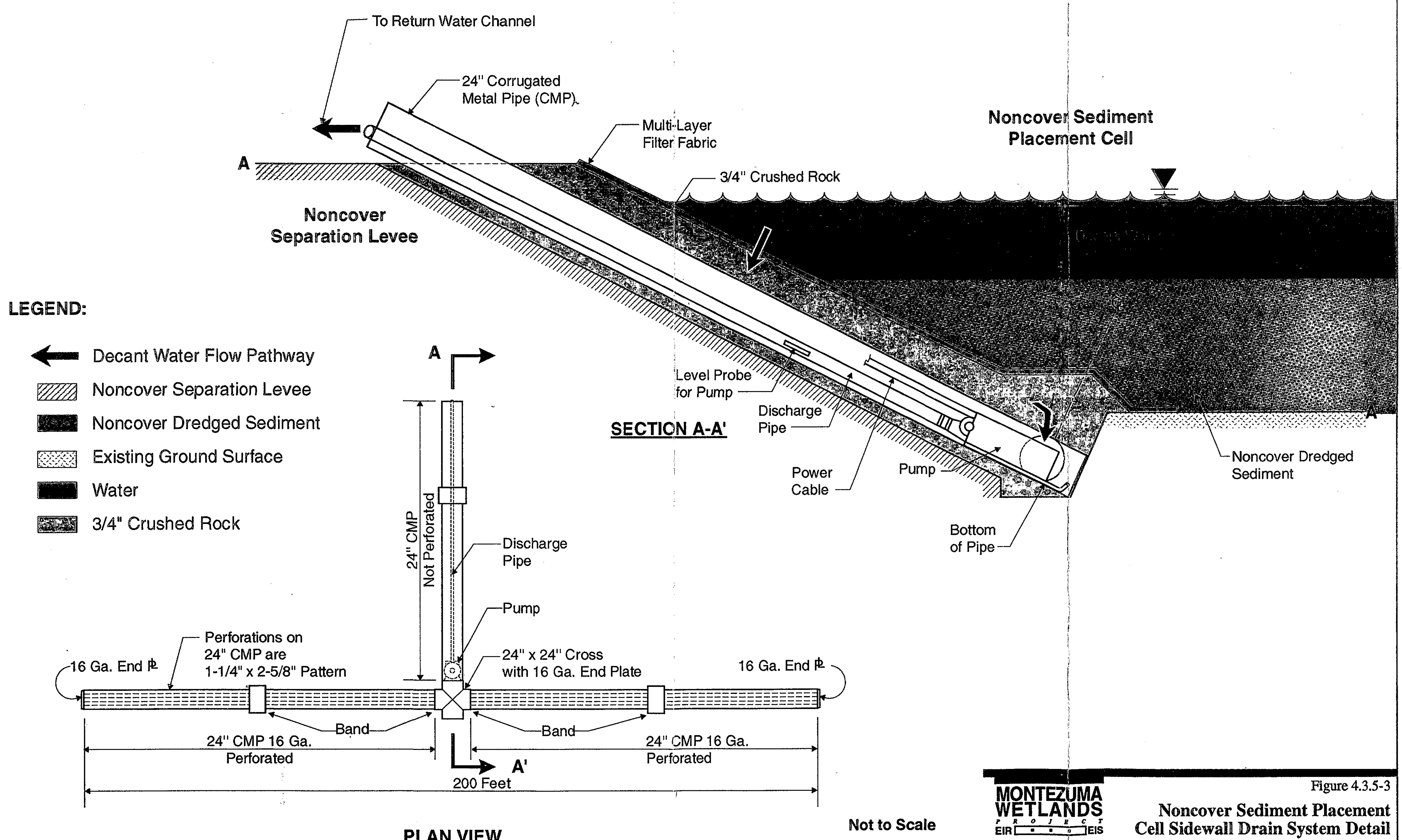

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Figure 4.3.5-3

Noncover Sediment Placement Cell Sidewall Drain System Detail

Source: Levine-Fricke (1995c)

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Applicant, and has an existing use permit/marsh development permit that expires in 1999. To continue operations after that time, Jerico would have to apply for an extension of the permit, which would be subject to environmental review by the County.

As part of the Project, a 90-acre rehandling facility would be constructed at the south end of McDougal Cut on its western shore, to dewater dredged materials for reuse on site and for off-site resale for beneficial reuse (e.g., for levee stabilization and construction in the Delta, and landfill daily cover in the Bay-Delta region). The proposed rehandling facility would accept materials identified by regulatory agencies as suitable for reuse, which would be predominantly cover material. Dried sediments generated by the facility would be used for levee construction on-site and for off-site resale.

In conjunction with the CALFED Bay-Delta Program, the Department of Water Resources has identified a heavy demand in the Delta for rehandled sediments that can be used in levee rehabilitation and habitat restoration. This is the most likely market for sediments rehandled by the facility. This EIR/EIS evaluates the environmental effects of operating the facility, but does not evaluate the environmental effects of off-site use; the latter would be the end-user's responsibility. At this time, the capacity of the rehandling facility is estimated to be approximately 400,000 cubic yards per year. This volume is 20 percent of the anticipated annual volume of 2 million cubic yards accepted over the life of the Project. To lessen the potential effect of off-site sales on the progress of wetland restoration, the applicant proposes to limit off-site sales to no more than 20 percent of the volume of sediment received while phase construction and filling are in progress.

The rehandling facility layout was designed to minimize impacts to existing jurisdictional wetlands. After further consultation with Bay Area environmental groups in 1993, 19.82 acres of existing SMHM habitat were removed from the proposed rehandling facility area.[6] While construction of the rehandling facility will impact 14 acres of jurisdictional wetlands, these wetlands were determined to be of relatively low-quality habitat value because the vegetation is dominated by *Lepidium latifolium*, a noxious, exotic plant. The project's creation, restoration, and enhancement of wetlands elsewhere on the site is designed to provide mitigation for these impacted areas (see section 4.2). The rehandling facility would be composed of three sediment rehandling cells (which could be divided into smaller cells), a staging area, and the make-up water pond, occupying an area of 90 acres as shown in Figure 4.2-4. Water drained into the make-up water pond would either be used to slurry sediments for wetland restoration or discharged into the Sacramento River through an 18-24 inch discharge pipe (see sections 4.3.5 and 4.6.3.5).

The existing access road and utilities would be realigned to the perimeter levee along the McDougal Cut. This levee would be improved as access for site personnel and construction traffic. The alignments of interior containment dikes would be constructed as needed. The conceptual alignment of the interior dikes of the sediment rehandling facility is shown in Figure 4.2-4; these dikes separate the area into three cells. Assuming the site is filled with 4 feet of sediment, the site would contain a volume of 0.37 million cubic yards.

Before operations begin, the area of the proposed rehandling site would be cleared and graded. Initially, approximately 2 feet of fine-grained sediment would be placed to even out site topography and provide a level base for subsequent sediment placement and scraping.

6 LFR letter to Corps, August 5, 1993(n)

During operation of the rehandling facility, dredged materials would be off-loaded from barges at the off-loading facility and pumped through a 20-inch pipeline to one or more of the containment cells. Pumping distances would be between approximately 500 and 2,200 feet, depending on which area is being filled. At the facility, water would be added to bring the off-loaded slurry to the desired consistency, or viscosity. This would also lower the salinity in the sediments. Once the dredged sediments have settled within the containment areas, water would be drained to the return water sump or settling pond for further clarification. Upon completion of this final clarification, the water would be analyzed for constituents regulated by the Regional Water Quality Control Board under the NPDES discharge permit. The water would then be discharged into the Sacramento River or reused as makeup water.

Once evaporation, infiltration, and handling have dried the sediments, the processed sediments would be stockpiled near on-loading/off-loading facilities with scrapers on an as-needed basis. Rehandling activities are expected to be conducted throughout the wetlands restoration site preparation, sediment placement, and short-term wetlands establishment phases of the project. At the end of these phases, the ground surface at the rehandling facility would be left at +5 to +10 feet NGVD elevation.

Dredged materials rehandling operations would be expanded onto the Jerico Towing Company site to store nonhazardous and nontoxic sediment amendments or additives, such as organic compost or limestone, for potential use on site. A barn-sized, open-walled rectangular storage facility with a sloped corrugated roof would be constructed to store sediment amendments. If demand for dried sediments continues after completion of the wetlands project, the rehandling facility could continue operating, which would require an additional use permit from Solano County. If the facility is not reauthorized, the portions of the site that are constructed on wetlands could be restored to wetlands after Project completion.

4.3.7 Ancillary Facilities

Trailers for a field office and laboratory would be located near the off-loading area at the southeast corner of the site. Electrical power would be supplied to the field office area. The existing 12-kV electric distribution line would be relocated parallel to McDougal Cut, adjacent to the new access road. Telephone service would be carried on the new power poles. PG&E's "modified-raptor construction" specifications would be used, resulting in wires six feet or more apart, consistent with Solano County policies. Diesel fuel to power the dredged materials slurry pumps and construction equipment would be stored on site in a 5,000- to 10,000-gallon above-ground diesel storage tank. Potable water would be supplied by newly constructed on-site water supply wells or by truck to the construction trailer and work areas. Portable toilets would be located at the construction trailer and work areas. Parking and storage areas would be provided adjacent to the field office. Two boat launch ramps would be constructed, one on McDougal Cut at the Sacramento River, and another at the end of Dinkelspiel Road. Boats would be used to inspect levees and channel outfalls and to monitor wetlands.

4.3.8 Access Roads

4.3.8.1 Primary Roads

Fire Truck Road and Dinkelspiel Road would remain unchanged and serve as primary access. They would be used for access throughout the life of the project. A dirt and gravel road currently exists on top of the perimeter levee. It would be maintained and repaired as necessary for safety and used throughout the life of the project.

The existing shoreline access road would be abandoned and a new road constructed for primary access adjacent to the McDougal Cut channel. This road would extend between the Jerico Towing Facility (Figure 4.2-4) and the shoreline at the off-loading facility. The road would serve as the primary access road during construction of the off-loading facility. The road would be graded, leveled, and expanded to about 10 feet wide. It would be elevated above the upland habitat in the area.

4.3.8.2 Secondary Roads

Both phase levees and cell levees would be used for temporary secondary access roads to provide construction access throughout the site during construction. Secondary roads would be unpaved dirt or gravel, and would be abandoned at the completion of each phase.

4.3.9 Public Access Facilities

Additional parking and viewing platforms would be added to the DWR day use area. A new public access facility would be built as part of Phase IV, consisting of parking, a viewing platform and a boardwalk on a knoll south of Fire Truck Road. (See section 4.10.1.1 for discussion of proposed amendments to the Solano County General Plan that provide for scientific and educational uses of the restored tidal and seasonal wetlands.)

4.3.9.1 Department of Water Resources Day Use Area

The DWR Day Use Area would be improved from its preconstruction configuration. The improvements would include additional parking, viewing platforms to view restored wetlands, and extended nature trails along the perimeter levee south from the DWR Day Use Area to the Phase II levee breach, and along new levees surrounding the Day Use Area (Figure 4.2-3). Existing access along Fire Truck Road to the DWR Day Use Area would be maintained during construction and following project completion.

4.3.9.2 Phase IV Public Access

The Project Applicant proposes to construct a public access facility as part of Phase IV. A recreational area consisting of a rustic, unimproved parking area, wooden boardwalk, and viewing platform overlooking the restored wetlands would be developed atop a knoll south of Fire Truck Road (see Figure 4.2-3). The viewing platform would be constructed upon completion of sediment placement and wetland construction activities in Phase IV. The access area would have portable toilets and parking spaces, access for disabled persons, and nature interpretation elements.

4.3.10 Infrastructure

Prior to receipt of the first shipment of dredged materials, approximately 4,300 feet of above-ground power and telephone lines would be relocated along McDougal Cut and approximately 17,000 feet of above-ground power lines would be relocated from the Phase II and Phase IV areas to Fire Truck Road. Power lines would be 6 feet apart, consistent with Solano County policy to lessen hazards to birds.

An abandoned railroad alignment traverses Phases I and II of the proposed wetland. To avoid having wetland restoration preclude future rail access to the water-dependent industrial area, the Project Applicant has proposed granting an easement eastward across the property, a location which would be consistent with the Collinsville-Montezuma Hills Area Plan and Program. The Applicant does not intend to construct a rail line.

4.3.11 Project Employment

The Project would employ approximately 30 people during the initial 4-month site preparation phase. Based on the predicted availability of sediment, and calculations of the rate at which sediment can be off-loaded and placed in sediment cells, it will take an estimated 10-15 years to fill the site to capacity. During this time, a range of 20 to 46 people would be employed, depending on whether work occurred 8 hours a day or 24 hours a day. For a regular, 8-hour day, the Applicant would likely have 10 people working on site and a contractor would have another 10 people on site, for a total of 20 people. During periods of 24-hour operation, the Applicant would have an additional 6 people on site (16 people) and a contractor would have an additional 20 people on site (30 people), for a total of 46 people. The Project's operation schedule will vary in response to the rate of sediment delivery, which depends on the schedules of dredging projects, and seasonal dredging restrictions that may apply for some projects. Sediment operations will continue until site capacity is reached.

4.4 Landscape Elements

Aside from the levees (see section 4.3.2), the restored wetland would include 10 main landscape elements, as described below and shown in Figure 4.2-2. These include:

- Intertidal Channels (79.5 acres)
- Low Marsh (1,440 acres)
- High Marsh (145 acres)
- Upland Transition and Buffer (380 acres)
- Intertidal Ponds (6.6 acres)
- Seasonally Wet Depressions (43.1 acres)
- Diked Pickleweed Marsh (48.1 acres)
- Managed Fluvial Hollows (32.3 acres)
- Clank Hollow (28.8 acres)
- Loafing and Nesting Islands (6.5 acres)

Additional description is provided below.

4.4.1 Intertidal Channels

Refer to section 4.3.4 for an overview of the revised channel design. These channels provide tidal circulation for flooding and draining the intertidal marsh. Five different orders (i.e., sizes) of channels will be constructed which will provide a diversity of habitat for fish and wildlife. *Intertidal Point Bars* for fisheries habitat will be constructed in these channels by widening selected portions of the internal levee slopes to 5:1 to 10:1 (horizontal:vertical). The largest channel in each Phase will be connected to Montezuma slough or the Sacramento River through a breach in the existing perimeter levee.

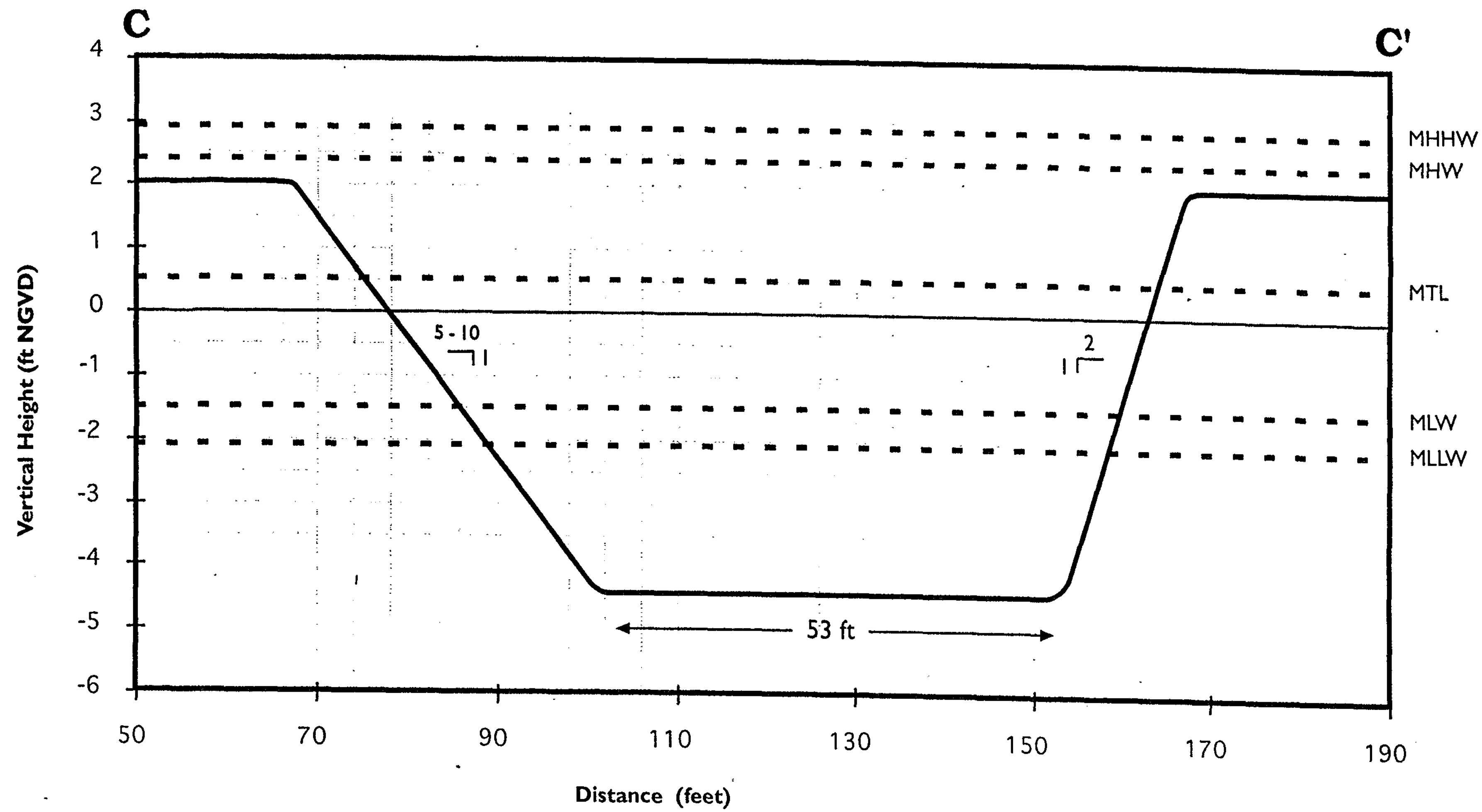
The tidal channel network would consist of a number of channels that vary in size. For the proposed project, there would be five "orders" of channels, which vary by size, as described below. The smallest, singular channels in the system are considered to be first order. The order increases when two channels of the same order connect. For example, when two first order channels join, the subsequent portion of the channel is considered to be second order. A third order channel forms when two second order channels join, and so on. Description follows:

- *First and Second Order Channels.* Smaller first and second order channels would be allowed to form naturally by tidal action. Second order channel locations may be guided by grading the surface to create very shallow drainage depressions with total relief of less than 1 to 2 feet. These channels could also be constructed intentionally to prevent areas of standing water and to avoid the need for mosquito control. Construction of first and second order channels would be performed with mechanical grading equipment capable of working in saturated mud. A wide variety of specialized equipment exists, consisting primarily of two types, both of which are readily and commercially available:
- Low track pressure vehicles, consisting of lightweight, low-pressure, track-mounted vehicles, such as "Mudcats," that can work on soft soils and marsh sediments.
- Amphibious equipment, capable of operating in a ponded environment with drafts as low as 6 inches of water. This equipment is available under the "Aqua-Mog" brand name.
- *Third Order Channels.* Third order channels, with widths ranging from 10 to 27 feet and average MHHW depths of approximately 5.9 feet, would be constructed like fourth order channels.
- *Fourth Order Channels.* Branching off the large channel would be three slightly smaller fourth order channels with widths ranging from 15 to 20 feet and MHHW depths of about 5.9 feet. These channels would be constructed like fifth order channels, or with a single levee and excavation of sediment (cover sediment only) adjacent to that levee to create the actual channel path. The fourth order channels would be constructed before each phase is opened to tidal action. Levees used during sediment placement operations would be used as much as practical to form these channels.
- *Fifth Order Channels.* For each phase, there would be one large fifth order channel with bottom widths ranging from 59 to 85 feet and average MHHW depths of 7.9 feet. Levees would be constructed on either side of these channels. The fifth order channels would be constructed in each phase before it is opened to tidal action. Levees used during sediment placement operations would be used as much as practical to form the fifth order channels.

Medium and large intertidal channels (third to fifth order) would be formed by constructing two parallel levees that delineate the channel. These levees would thus become the channel banks. Levee side slopes would be 2:1 (horizontal:vertical) and would be widened in numerous locations to provide lower gradient (5:1 to 10:1) intertidal "point bars" to provide fisheries habitat. The total surface area of intertidal channels at high tide would be approximately 67 acres, with point bars comprising an additional 12.5 acres. Figures 4.4.1-1 and 4.4.1-2 show a typical channel with a left bank point bar and a right bank point bar, respectively.

4.4.2 Low Marsh

In the revised project design (Table 4.3-2), the acreage of low marsh has been increased, the acreage of high marsh has been reduced, and the design elevations of both have been lowered. These changes are intended to facilitate natural sedimentation and the evolution of the marsh, and to deepen and thereby increase the isolation of non-cover material.

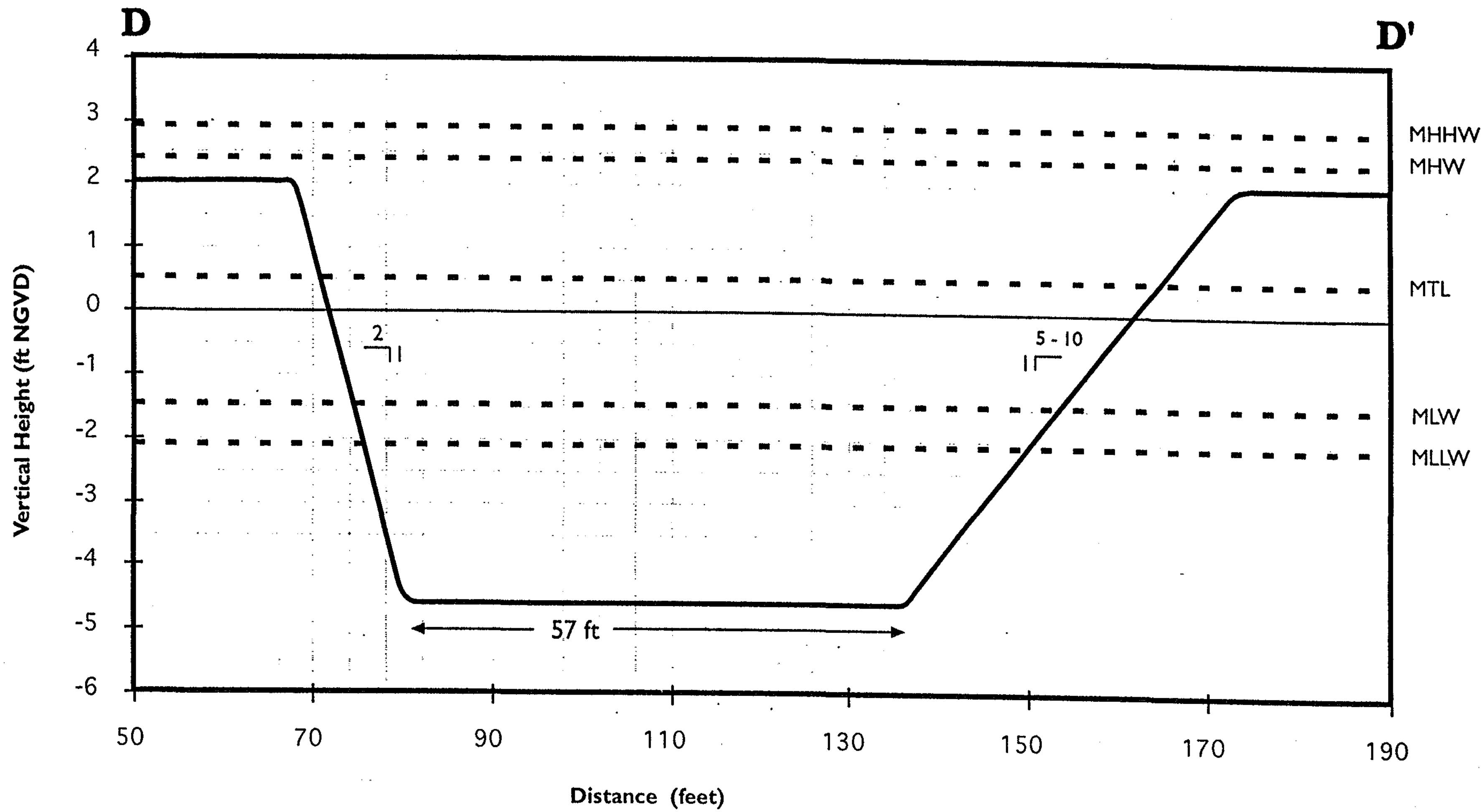


Source: Levine-Fricke (1995a)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.4.1-1

Typical Channel with Left Bank Point Bar, Cross Section C-C'



Source: Levine-Fricke (1995a)

MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 4.4.1-2

Typical Channel with Right Bank Point Bar, Cross Section D-D'

All project design elements have an elevational tolerance of 0.5 foot. Low marsh will be constructed 0.5 foot below MHW (+/- 0.5 foot) to allow for natural sedimentation to build up the low marsh surface. The low marsh will be inundated by about 70 percent of the high tides each year, and would be flooded by the tides about 20 percent of the time. It is designed to support predominately brackish emergent vegetation, such as tules (*Scirpus* spp) and cattails (*Typha* spp.), and to provide habitat for waterfowl, fish, reptiles and amphibians.

Approximately 1,440 acres of low marsh would be restored at project completion. The low marsh plain would be 0.5 foot below MHW and would be in the western part of the site, adjacent to Montezuma Slough. Approximately 79 acres of low marsh would be occupied by ponds for recycled water (one 32-acre makeup water pond in Phase IV and one 47-acre back-up makeup water pond in Phase II) until the project is complete or until they are no longer needed. They would then be converted to low marsh.

4.4.3 High Marsh

At the project site, the high marsh would have an elevation of Mean Higher High Water (MHHW) +/-0.5 foot (2.4 to 3.4 feet NGVD). It would be flooded by about 25 percent of the high tides each year (inundation frequency), and would be flooded by the tide 5 percent of the time (inundation duration). It is expected to support vegetation similar to that which occurs in the upper reaches of other tidal brackish marshes in the region, including pickleweed (*Salicornia virginica*) and other halophytes (salt-tolerant plants). High marsh would provide habitat for salt marsh harvest mouse (SMHM) shorebirds, song birds adapted to marshes, such as the common yellowthroat, and foraging habitat for raptors.

At project completion, high marsh areas would cover 145 acres of the site, generally in the eastern portion of the restored wetland. High marsh is designed to be habitat for the salt marsh harvest mouse (SMHM), a special status species. Prior to opening to tidal action, high marsh areas would be irrigated to encourage germination of seeds incorporated in the top layers of placed sediment. The vegetation established by irrigating the cells prior to tidal restoration is designed only to stabilize the dredged materials so that erosion is minimal after levees are breached. The initial vegetation is not expected to be the basis of marsh restoration. Two intertidal ponds, totaling approximately 6.6 acres, and a total of about 43 acres of seasonally wet depressions, each about 2.5 to 5 acres in size, would be located at the upland edge of the high marsh. The purpose of the ponds and seasonally wet depressions is to provide foraging and loafing habitat for wildlife species dependent on shallow standing water, such as waterfowl and shorebirds. To attain the desired inundation frequencies and duration, they would be impounded by low berms set to specifically engineered elevations.

Habitat for the salt marsh harvest mouse (SMHM) would include the 145 acres of high marsh, 48 acres of managed pickleweed marsh (0.5 foot below MHW), and 18 acres managed in fluvial hollows. Seasonally wet depressions would also provide SMHM habitat.

4.4.4 Upland Transition and Buffer

This landscape element comprises the transitional habitat above and generally along the eastern margin of the constructed wetlands, extending into the adjacent uplands of the project site. The lower fringe of this habitat would be tidally influenced. This area will provide refugia for marsh wildlife during the highest tides and storm events, as well as habitat for upland wildlife species. It also provides a buffer between the project's wetlands and adjacent agricultural land use.

An upland transition and buffer zone would be located in the area between the eastern edge of the high marsh and the +10-foot NGVD contour. This area would be mostly left undisturbed. This upland transition and buffer area would occupy approximately 380 acres between the restored wetland and the eastern project boundary. The width of the buffer zone would be an average of 400 feet, although it would vary from 50 to 1,000 feet.

4.4.5 Intertidal Ponds

These ponds (sometimes called salt pans) are natural features of historical tidal marshes in the San Francisco Estuary. Two experimental ponds are designed in the high marsh plain on drainage divides isolated from channels. These ponds will receive water by overland flow from higher tides, and from elevated groundwater levels and direct rainfall. These ponds are designed to provide habitat primarily for foraging shorebirds and waterfowl.

Two experimental intertidal ponds would be constructed in the high marsh area of Phase I to provide shallow water foraging habitat, primarily for waterfowl and shorebirds. The two ponds would cover 6.6 acres and have water depths up to 18 inches. The ponds would support shallow standing water for 10 to 12 months a year. Material excavated to construct the ponds would be used to build the rim of the ponds. If the ponds prove successful in providing ecological functions and in avoiding unacceptable fish entrainment, additional ponds may be included in subsequent project phases.

4.4.6 Seasonally Wet Depressions

These features are essentially seasonal ponds that will receive primarily freshwater inputs, plus very limited overland tidal flow during the infrequent winter and summer supratidal conditions.

Seasonally wet depressions would occupy 43 acres along the upland edge of the high intertidal marsh and 14 acres in fluvial hollows. Water inputs would include infrequent flooding from spring tides, rainfall runoff, and direct rainfall. These depressions (depths of up to 20 inches) would provide seasonal foraging and breeding habitat for shorebirds and waterfowl, and potential habitat for the SMHM.

4.4.7 Diked Pickleweed Marsh

An approximately 48-acre diked marsh would be managed to cultivate pickleweed (*Salicornia virginica*) as the dominant species. This marsh is intended to provide higher quality, predictable habitat for the SMHM. This element was added to the revised project design to help offset the reduced acreage of high marsh that had originally been intended as habitat for the SMHM. It would also provide seasonal shorebird and waterfowl habitat. This area would receive considerable revegetation effort and would be irrigated as needed with pumped groundwater until the Phase I levee is breached, after which it would be subject to a managed water regime similar to those used in diked wetlands throughout Suisun Marsh. If monitoring indicates greater resource benefits here than what is achieved in other SMHM habitat areas on the site and there are no other adverse impacts (e.g., unacceptable fish entrainment), additional diked pickleweed marshes may be included in later phase areas.

4.4.8 Managed Fluvial Hollows

The colloquial term "hollow" refers to a ravine or low-lying area that is smaller than a valley, but larger than a gully. A hollow created by the erosive action of flowing water—a "fluvial" process—is appropriately termed a fluvial hollow. The project site includes five unnamed fluvial hollows, plus a larger, named one, Clank Hollow (discussed separately below), all of which were in the previous project design proposed to be filled with dredged material and converted to high marsh. They would be incorporated into the revised project design as follows.

Four fluvial hollows, in this case consisting of low-lying, remnant stream channels at the edge of the upland transition zone, would be managed to promote the growth of pickleweed prior to the reintroduction of tidal action. This would be done by controlling the timing and duration of flooding, as is done elsewhere in the Suisun Marsh (e.g., at Grizzly Island), and through the cultivation of pickleweed. If successful, this would, provide higher quality, predictable habitat for the SMHM. The timing and extent of inundation in a fifth fluvial hollow would be controlled to provide shallowly ponded habitat for shorebirds. All five hollows would be located in Phases I and II, four of which (18.4 acres total) would support SMHM habitat. One hollow in Phase II (the easternmost, 13.9-acre hollow) would support shallow shorebird habitat. In addition, artificial ground squirrel burrows would be created along the upland margins to provide burrowing owl nesting sites. The areas targeted for SMHM habitat would receive considerable revegetation effort and all of the hollows would be irrigated with pumped groundwater as needed until connection to a tidal source when the Phase II levee is breached.

4.4.9 Clank Hollow

This hollow is the largest existing low-lying, remnant stream channel area on the project site, occupying 28.8 acres at the eastern edge of Phase I. This hollow would not receive dredge sediment but would be open to managed tidal flows, the purpose of which will be to encourage the growth of pickleweed and other halophytes that can support the endangered salt marsh harvest mouse. Secondary functions would include seasonally ponded habitats for shorebirds, wading birds, and waterfowl.

4.4.10 Loafing and Nesting Islands

These "islands" are features that provide some topographic variation within the marsh plain. These islands will be created by grading down sediment cell levees to within a foot of the constructed low marsh plain (none will exceed MHHW). The "islands" will provide isolated loafing habitat for birds during the lower high tides and will function as windbreaks to facilitate sedimentation.

When sediment placement activities are completed, the interior levees constructed to define sediment placement cells would be lowered to the height of the adjacent constructed marsh. However, small sections of these interior levees would be graded to elevations of approximately 1 foot above the surrounding marsh plain (no higher than MHHW) and planted with native marsh vegetation. These "islands" will be sited so as to provide low windbreaks or breakwaters that will reduce fetch distances and facilitate sedimentation and marsh development. They will also provide habitat for the SMHM, as well as loafing or resting sites for other wildlife when the adjacent marsh is submerged.. Each island would be approximately 300 feet long, would vary in top width from 10 to 22 feet, and have a maximum side slope of 2:1.

4.5 Research Elements

The design of the project includes two research projects: (1) identifying optimum revegetation techniques; and (2) evaluating the effectiveness of intertidal ponds.

Identify Optimum Revegetation Techniques. The revegetation research project has two goals:

- To identify those revegetation techniques that produce the fastest rate of increase in percent cover of the target plant species and simultaneously minimize the establishment of exotic species; and
- To understand the conditions under which optimal revegetation occurs, Particular emphasis would be placed on revegetation of pickleweed (Salicornia virginica) because of its importance as SMHM habitat. Revegetation techniques would range from active replanting of cultivated nursery stock to natural recolonization.

Evaluate Intertidal Pond Effectiveness. The goal of the intertidal pond research project is to determine whether the two ponds included in Phase I add value to the ecological support functions of the site, and simultaneously ensure that they do not pose an entrainment hazard to special status estuarine fish species (winter-run chinook salmon, delta smelt, Sacramento splittail). Based on the results of this research project, additional ponds in later project phases may be considered.

4.6 Operation Activities

4.6.1 Transport and Off-Loading

Dredged materials would be transported to the site by barges which each hold up to 4,000 cubic yards of material. Barges would moor at the off-loading facility while sediments are being unloaded, a process that takes about 3 hours. The dredged sediment would be pumped out through the pipeline to the designated disposal area. Because the sediments may be too stiff, too dense, or too high in solids for pumping through a pipeline when they reach the site, groundwater or water from the makeup water pond would be added to the barges to make the mud and water mixture called slurry.

The sediment would be pumped through the transport pipeline to the cells and deposited in layers known as "lifts." Non-cover material in the cells would be covered by a minimum 3-foot-thick layer of cover material. The sediment in the slurry would settle over a period of time. Sand and larger grained material would settle first, and the finer-grained material would settle out last. The faster-settling coarse-grained material could collect at the mouth of the discharge pipe, causing localized mounding. In order to prevent mounding, the location of the discharge pipe will be moved to different locations within the placement cell, as described in Mitigation Measure P-HYDRO-3b (section 6.7).

Water would be decanted off the cells into channels and routed to the makeup water pond before a subsequent lift of sediment would be placed. The placement and draining operation in each cell would continue until a target elevation is reached. Several cells would be operating simultaneously to allow for disposal of a large quantity of sediment at the same time and for flexibility in receiving and placing cover and non-cover sediments.

The maximum rate of acceptance of the dredged materials, assuming 24 hours per day off-loading, would be approximately 60,000 cubic yards per day. This rate could not be achieved for an extended period of time, given that the slurry would need time to settle before new slurry could be added.[7] It is more likely that the average rate of acceptance would be about 20,000 to 30,000 cubic yards per day.

7 Kim Buchanan, Levine-Fricke, verbal communication, October 22, 1992.

4.6.2 Elevation Control

Surface elevations at the site would be monitored at a number of locations, including: intertidal channels, the intertidal marsh plain, intertidal ponds, seasonally wet depressions, loafing and nesting islands, diked pickleweed marsh, perimeter and phase levees, sediment cell levees, and non-cover separation levees. Surface elevations will be monitored, controlled, and if necessary, corrected as follows:

1. Computer modeling would be performed to calculate the expected fill elevation based on physical parameters of the dredged sediment.

2. Grade poles would be placed within the sediment placement cells and surveyed from the levees to monitor fill elevations. Benchmarks installed on these levees would be routinely surveyed to fixed upland benchmarks to ensure accuracy in measured elevations.

3. A network of resistivity probes would be installed within the sediment placement cells before sediment placement to monitor sediment elevation. Data would be collected continuously from the probes and would be processed with a computer to develop vertical profiles of the elevation of placed sediment during placement operations. This will allow for ongoing monitoring and prediction of elevation within the dredged sediment to ensure that final grade elevations meet marsh restoration objectives. This method also allows for monitoring of density changes within the dredged sediment and prediction of when the dredged sediment has consolidated to an optimum density.

4. Sediment placement will be pulsed; i.e., lifts of sediment will be placed in alternating cells, and fill elevation will be determined for each lift after initial consolidation. Each successive lift will be thinner, to decrease the margin of error in achieving final design elevations. The thickness of fill lifts would be documented through record keeping from the first three steps above.

5. The slurry pipeline discharge location would be recorded on site drawings. The slurry pipeline discharge point will be moved to several locations within each cell to prevent mounding.

6. The performance of the subdrain system would be monitored with piezometers installed along the perimeter of the sediment placement cells to measure shallow groundwater elevations.

7. Settling times would be documented through recordkeeping from the first three steps.

8. Monitoring of fill elevations would be done biweekly during active placement of dredged sediment until the fill elevation is within approximately 1 foot of the design elevations for both cover and non-cover sediment; then the monitoring would be increased to weekly. Monitoring would be conducted monthly after each perimeter phase levee is breached. If monitoring results indicate that fill elevations have been exceeded, overfilled cells will be graded down to design elevations within six months of completion of sediment placement within each cell. Equipment capable of operating in a marsh environment will be used, in order to avoid the need to dewater cells and expose sediment to oxidation in the process.

4.6.3 Water Use

An average of about 5 million gallons (15.3 acre-feet) a day (mgd) of water would be needed for sediment slurry for an average of eight barges of dredged material per day. The applicant is proposing to recycle as much water as practical, with additional water being pumped from the groundwater supply. An average of 2,000 gallons per minute of shallow groundwater would be pumped from on-site wells to slurry dredged materials. Since peak water demand could exceed 2,000 gallons per minute, the makeup water pond and the secondary holding pond, if necessary, would be created to recycle water. Water for reuse would be stored in these ponds on site. The ponds would have a total capacity of 155 million gallons (approximately 475 acre-feet). A channel would connect the two ponds and the sump for the off-loading facility. With reuse of water on site, the Project Applicant estimates that average water use would drop well below 1 mgd over a 10 to 15 year project life.

4.6.3.1 Groundwater Extraction System

Shallow groundwater would be extracted using wells located within the Phase IV area of the site which is adjacent to the Sacramento River. Groundwater would be pumped from underlying sands that are hydraulically connected to the Sacramento River into the makeup water pond and mixed with the dredged sediment in the barges to create a slurry that can be pumped to the sediment placement cells. Water would be obtained by pumping shallow brackish groundwater from sandy sediment in the southern portion of the site. The groundwater extraction system would include a shallow groundwater extraction well network located along the southern perimeter of the site adjacent to Montezuma Slough in Suisun Bay (Figure 4.2-1). Water supply wells would be installed in a shallow water-bearing zone, which is encountered at approximately 20 feet below the ground surface. Available data indicate that this water-bearing zone is hydraulically separated from the deeper aquifer by a clay layer.

4.6.3.2 Makeup Water Pond

A 32-acre makeup water pond with a capacity of 80 million gallons (about 245 acre-feet) of water would be located adjacent to the sediment rehandling facility (Figure 4.2-4). This pond replaces the formerly proposed east holding pond. The makeup water pond would serve the following functions:

- Receive and store groundwater from the groundwater extraction wells;
- Provide a water source to mix into the sediment on the dredge barges for slurrying and pumping to sediment placement cells;
- Receive and store decant water removed from the dredged sediment placement cells and transported in the return water channel; and
- Serve as the final project water quality sampling point before discharge into the deep waters of Suisun Bay.

4.6.3.3 Secondary Holding Pond

A secondary holding pond, located in the northwest corner of Phase II (Figure 4.2-1), would be approximately 47 acres in size and have a capacity of approximately 75 million gallons (230 acre-feet) when filled to an elevation of +2 NGVD. This pond is intended to serve as a backup for the makeup water pond in the event that the effluent from the sediment placement cells needs to be diverted because of water handling problems in the makeup water pond during Phase I of the operation. The pond would be filled during Phase II of the project. The holding pond would be used to prevent the unauthorized discharge of water should the capacity of the makeup water pond be exceeded. This pond would also be used for additional water treatment, if necessary, before discharge into the waters of Suisun Bay.

4.6.3.4 Return Water Flow Channel

An existing channel at the site would be used (and may be improved as necessary) as the return water flow channel into the makeup water pond. The return water flow channel runs from the secondary holding pond in the Phase II area to the sediment offloading facility to the south (Figure 4.2-1). The channel is approximately 11,000 feet long and has an estimated capacity of 1.5 million gallons (4.6 acre-feet). The channel would be excavated and cleaned of debris as necessary to improve flow. Excavated soils would be used on site.

4.6.3.5 Water Discharge

After the slurry has been pumped through the sediment pipeline and discharged into the cells, the decant water would then be discharged through geotextile fabric on levee sidewalls in the non-cover sediment separation levees and over weirs from the cover-only sediment cells (figures 4.3.5-2 and 4.3.5-3). The discharged water would be monitored to test solids concentrations, and routed to the return water channel and the holding ponds. Water from placement operations would be monitored and periodically discharged, when excess water is not needed, to the Sacramento River at the makeup water pond by the off-loading facility. The water will be discharged through a pipe (18 to 24 inches in diameter and less than 100 feet in length) into the deep waters of the Sacramento River. Water would also be monitored and discharged periodically to maintain acceptable salinity concentrations for placement operations. The schedule and criteria for discharge would be established in the NPDES permit.

4.6.3.6 Irrigation

Before tidal action is returned to a phase, overhead irrigation would be used on sediment cells to prevent excessive drying of the sediment, encourage germination and growth of vegetation, and control the drying of ponds. Irrigation would also be used to identify areas of unplanned ponding or poor drainage that could become mosquito breeding sites.

4.7 Project Maintenance

4.7.1 Perimeter Levee

The perimeter levee would continue to be maintained during site preparation and sediment placement to reduce the possibility of levee failure. Maintenance may require the addition of erosion control material (e.g., blankets, netting, riprap, etc.) on the outboard slope along the reaches of the levee which experience prolonged high water and addition of soil to the levee crest to maintain a relatively smooth surface for vehicular access and to maintain crest elevation.

The perimeter levee would be maintained in each phase area until breached. After breaching each phase, the adjacent perimeter levee would be allowed to degrade naturally. As natural erosion is a relatively slow process, the perimeter levees would still provide vehicular access to breached phases during the early stages of marsh development. The presence of the perimeter levees during marsh development ill also minimize wave fetch lengths in the developing marsh which will encourage natural sedimentation and growth of emergent wetland vegetation.

4.7.2 Phase Boundary Levees and Cell Levees

Phase boundary levees will be built and maintained at an elevation of approximately +7 feet NGVD. After site filling has been completed, phase boundary levees will be maintained as roads, to allow vehicle access for site maintenance and monitoring. The western Phase III boundary levee is also intended to provide flood protection for areas immediately north and east of the Project boundary.

Cell levees will be constructed to maintain a minimum of two feet of freeboard above the dredged sediment/water slurry to avoid overtopping. After site filling has been completed, cell levees will be graded to the elevation of the adjacent marsh plain, except in locations that will become bird loafing and nesting islands. Graded material will be utilized on-site in upland areas. Target marsh plain elevations are provided in Figure 4.2-5a. Cell levees will be constructed at a lower compactive standard than phase boundary and perimeter levees to allow them to match changing site grades over time

4.8 Project Monitoring

The applicant prepared a Draft Monitoring Plan[8] for the Project which is on file with Solano County and the Corps (along with all of the other technical reports prepared by LF). A revised monitoring plan incorporating EIR/EIS mitigation measures and other conditions of project approval would be prepared in support of project permitting. Monitoring of ecological, sediment quality, water quality and engineering project aspects, as proposed, would occur over the 10-15 year life of the Project. Monitoring will be conducted during site preparation, sediment placement, and short- and long-term wetlands establishment Project phases. After Project completion, the applicant proposes to dedicate the wetlands to a public management entity (e.g., USFWS, DFG) and provide funds for long-term project monitoring.

The proposed monitoring program would be implemented to verify that the Project is proceeding toward meeting specific goals and meeting mitigation requirements. The monitoring program will be integrated with the County's AB 3180 Mitigation Monitoring and Reporting Plan, and with other monitoring as required by the Corps' Section 404 permit or other permits. The proposed monitoring program would include the formation of a technical advisory committee, consisting of regulatory agency staff, LFR staff, and other experts in the region, that would review monitoring results (including biological, chemical, and physical parameters) to assess project progress, to identify in a timely manner any elements that may need corrective action and recommend an adaptive management approach to rectify those elements, and to generate a database useful for designing and implementing similar wetlands restoration projects in the future. This EIR/EIS has incorporated some specific elements from the Draft Monitoring Plan, including monitoring approach, and various success criteria and contingency measures, after review and some revision by the lead agencies. The Monitoring Plan will be finalized by the applicant in support of the Corps § 404 and 10 Permits, and the County's Use and Marsh Development Permits.

The proposed monitoring program for the project would be implemented in four different stages. The monitoring program has been designed to complement the site baseline information, to verify that the project is proceeding toward meeting each stage's goals, as well as the overall goal of long-term wetlands establishment, to identify in a timely manner any elements that may need corrective action, and to generate a database useful for conducting similar wetlands restoration projects elsewhere. A summary description of proposed monitoring activities within each stage follows.

8 Levine-Fricke, March 26, 1996

Stage 1. Site Preparation

Monitoring during site preparation would focus on ensuring efficient and appropriate construction activities relative to the ecological health of the site. Monitoring during construction and site preparation would include:

- Establishment of tidal benchmarks for each phase and unit landscape.
- Monitoring subsurface and surface salinity, pH, dissolved oxygen, inorganic elements, temperature and water levels in relation to distance from tidal source.
- Monitoring phase levees and cell levees for stability during construction.

Stage 2. Sediment Placement

Monitoring during sediment placement would focus on collecting additional area-specific baseline data and ensuring efficient and appropriate sediment placement activities. Monitoring activities during sediment placement would include:

- Review of sediment quality data before acceptance at the site concurrent with and following agency review of these data for their respective dredging project permit reviews.
- Verifying fill elevations.
- Monitoring incoming sediment quality and comparison with preacceptance test levels.
- Monitoring salinity, total suspended solids (TSS), pH, nutrients (total sediment and soluble), oxidation-reduction (redox) potential, inorganic elements, temperature and water levels.

Stage 3. Short-Term Wetlands Establishment

Monitoring during short-term wetlands establishment would cover physical, chemical, and biological parameters to ensure that wetlands establishment is proceeding appropriately. Monitoring during this stage would include:

- Verifying fill elevations.
- Monitoring salinity, pH, nutrients, dissolved oxygen, redox potential, turbidity, TSS, inorganic elements, organic matter, nitrogen levels, sulfides, temperature, and water levels.
- Monitoring adjustments in cross section and plan of large order tidal channels, and evolution of smaller channels.
- Monitoring sediment particle size distributions and natural sedimentation rates relative to distance from tidal sources.
- Biological monitoring, including the distribution and cover of plant species or assemblages, and avian and mammal use.

The chemical monitoring would focus on the evaluation of potential leaching of various compounds from the imported dredged materials. The biological monitoring of vegetation, resident wildlife, and avian use would be performed at a frequency that reflects the rate of their colonization and seasonal use.

Stage 4. Long-Term Wetlands Evolution

Monitoring during long-term wetlands evolution would address physical, chemical, and biological parameters to ensure the continued physical and chemical functioning of the site and to document the wetlands evolution. This stage is designed to provide a significant amount of scientific information useful for similar wetlands restoration projects elsewhere. Monitoring throughout this stage would include:

- Verifying fill elevations.
- Monitoring salinity, pH, nutrients, dissolved oxygen, redox potential, turbidity, inorganic elements, organic matter, nitrogen fixation, sulfides, temperature, and water levels.
- Monitoring adjustments in cross section and planform of large and small tidal channels.
- Biological monitoring including vegetation establishment, wildlife and avian use, and wetlands processes.

The chemical monitoring would focus on the potential leaching of various compounds from the dredged materials brought to the site. The biological monitoring would focus on the colonization and dynamics of individual species of interest, populations, and communities, with an emphasis on monitoring the evolution of the tidal wetlands ecosystem. Monitoring would be performed on a frequency that reflects the seasonal dynamics and evolution of the biotic communities.

4.8.1 Monitoring Parameters

Site Physical Characteristics

Important site physical characteristics would be evaluated during each of the four monitoring stages. The parameters to be evaluated include ground elevations, channel cross sections and plan elevations, sedimentation, surface and groundwater levels, perimeter levee conditions, and tidal datums.

Water Quality

Water quality measurements are required to evaluate the effectiveness of the wetlands construction and to assess potential biological impacts. Parameters to be measured include pH, inorganic elements, nutrient concentrations, turbidity, TSS, dissolved oxygen, salinity, and temperature. Surface-water samples would be standardized with regard to tidal stage, flow, and location within the site, to the extent possible. Surface-water samples may also be collected north of the site in Montezuma Slough, and south of the site in the Sacramento River. Groundwater would be sampled at monitoring wells to be installed at strategic locations at the site. Dredged materials decant water would be sampled near discharge locations.

Biological Monitoring

Biological monitoring would commence to a small degree during sediment placement, and expand during the short-term wetlands establishment and long-term wetlands evolution activities. As the tidal marshland within each phase matures, both the scope and the intensity of biological monitoring would be restricted to a set of routine operations designed to assess long-term ecological trends or cycles. Monitoring would include evaluating vegetation, wildlife and selected wetland ecological processes.

Perimeter Levee

The perimeter levee would be monitored on an annual basis, and after such events as large storms or earthquakes. Monitoring should include inspecting for seepage, sinking of the levee crest, levee depressions, lateral movement of the slope, levee surface erosion, heave near the levee toe, development of tension cracks (which give advance warning of failure), stability, animal burrows, and levee growth.

The levee on the western side of Montezuma Slough would be monitored twice annually and would evaluate whether potential alterations in surface water velocities in Montezuma Slough are comprising levee integrity.

4.8.2 Sediment Placement Monitoring

Ensuring the suitability of sediments imported to the site would be an integral component of the monitoring conducted during the sediment placement activities. Although all dredged materials brought to the site would have been determined to be suitable for acceptance by the regulatory agencies, random confirmation testing of sediment quality would also be performed.

Coordinated 24-hour monitoring would be required because the dredging and subsequent transport of dredged materials to the site may be performed on a round-the-clock basis. Three separate operations would be monitored: sediment off-loading; transport and placement of sediment from the off-loading barge to the cell; and discharge of decanted/sediment dewatering water from the placement system.

4.8.3 Daily Reconnaissance

Physical reconnaissance of the site would be conducted on a daily basis during active sediment transport and placement. The review would include visual monitoring of cell levee integrity, sediment placement, control of water associated with the sediments, and fill elevation control.

4.8.4 Sediment Off-Loading

In addition to observations of the actual sediment off-loading, physical and chemical sediment-quality and water-quality parameters would be measured to provide confirmatory information about the imported sediments, as well as information regarding the quality of the slurry water held within the site reuse system for potential discharge.

4.8.5 On-Site Sediment Transport and Placement

The water and sediments in the placement cells would be monitored periodically to evaluate several physical and chemical characteristics. These parameters would include pH, selected metals, and salinity.

During water discharge activities, the receiving water would be monitored periodically to evaluate several physical and chemical characteristics. Whenever possible, receiving water samples would be collected at slack tide. Water-quality parameters to be measured include pH, selected metals and salinity.

In addition, receiving water standard observations would be recorded, including the presence of floating or suspended materials, discoloration and turbidity, odor, and evidence of beneficial uses (e.g., the presence of birds or other wildlife). Additional information to be collected includes hydrographic conditions (time and height of tides, depth of water column, and sampling depths) and weather conditions (air temperature, wind direction, and precipitation).

4.8.6 Monitoring Frequencies

Monitoring frequencies would be determined during project permitting, based on EIR/EIS mitigation measures, lead agency conditions of approval, and conditions associated with other Project permits such as the NPDES permit.

4.9 Long-Term Project Management

Following construction, the Project Applicant proposes to dedicate the wetland to public ownership, to be managed and operated by either a public agency or a non-profit organization in the public interest. Specific entities that will accept ownership have not yet been identified.

Although specific entities that will accept ownership and management responsibilities have not yet been identified, potential public entities could include (either individually or collectively): the California Coastal Conservancy, California Department of Fish and Game, the San Francisco Bay Joint Venture, BCDC, The Nature Conservancy, the Solano Land Trust, and the Corps. After project completion, the Applicant will be responsible for implementing project monitoring and maintenance until ownership and management are assumed by another entity.

The sediment rehandling and offloading facility portion of the Project will remain under ownership of the Applicant if approved for continued use after the completion of the marsh restoration portion of the project.

4.10 Plan and Policy Amendments

The following discussion describes the changes proposed to various elements of the Solano County General Plan, Local Protection Plan, and zoning ordinance, and changes to BCDC's Suisun Marsh Protection Plan and San Francisco Bay Plan that were adopted by BCDC on April 20, 1995. The Solano County Local Protection Plan (LPP) is a compilation of the General Plan and other Solano County ordinances pertaining to the Suisun Marsh. This policy plan is not specifically described below since it repeats the requirements of the zoning ordinance and the General Plan. However, page references are provided to both the General Plan element, zoning regulation, or other ordinance or regulation, and the section of the LPP where the provision is duplicated.

4.10.1 Solano County Policies and Regulations

Land use and policy regulations that apply to the Montezuma site include those found in the Solano County General Plan [specifically the Land Use and Circulation Element (LUCE), the Resource Conservation and Open Space Element (RCOSE), and the Collinsville-Montezuma Hills Area Plan (CMHP)] and the Solano County Zoning Ordinance (ZO). Amendments have been proposed to these documents to allow for the Montezuma Wetlands Project. The Solano County Local Protection Plan (LPP) is a compilation of policies from the General Plan and the zoning ordinance. To the degree that these documents are amended, the LPP will also be amended.

4.10.1.1 Solano County General Plan (LUCE, RCOSE, and CMHP)

Proposed amendments include the following:

LUCE:

- The Marsh and Wetland Habitats Land Use Proposals in the Land Use and Circulation Element (LUCE) (LPP p. 7; LUCE p. 41) would be amended to allow restoration of historic tidal wetlands using dredged materials to raise site elevations.
- A third policy would be added to the Water-Dependent Industrial District in the LUCE (LPP p. 13; LUCE p. 101) to allow for wetland restoration in areas with this land use designation. Restored wetlands would be eliminated from future consideration for industrial development.

RCOSE:

- The Resource Conservation and Open Space Element (RCOSE), Policy 1(e) under "Utilities, Facilities and Transportation" (LPP p. 23; RCOSE p. 48) would be amended to recommend that rail access to the Sacramento River and through the water-related industrial reserve area should be located above the 10-foot contour wherever possible, in order to avoid adverse impacts to wetlands.
- RCOSE policy 9(c) under "Utilities, Facilities and Transportation" (LPP p. 28; RCOSE p. 53) would be amended to allow use of dredged materials for restoration or enhancement of tidal, managed, or seasonal wetlands.
- Amend RCOSE policy 2 under "Recreation and Marsh Access" (LPP p. 30; RCOSE p. 54a) to add scientific and educational uses to the uses listed. .
- CMHP: "Current Plans and Policies" (LPP p. 33; CHMP p. 15) would be amended to allow tidal and seasonal wetland restoration with approved dredged sediments. Restored wetlands should be protected from future industrial development, and a buffer should be provided between future industrial development and restored wetlands.
- "Area-Wide Land Use and Transportation Policies, Wetland Habitat" (LPP p. 33; CHMP p. 22) would be amended to encourage restoration of lowlands within the water-related industry area by using dredged sediment fill.
- "Area Wide Land Use and Transportation Policies, Water-Dependent Industrial, Acceptable Water -Dependent Use Categories..."(CMHP p. 26) would be amended to add dredged sediment rehandling for on-site and off-site uses as an acceptable water-dependent use category for designated water-dependent industrial areas.
- "Area-Wide Land Use and Transportation Policies, Railroad Branch Line Track" (LPP p. 36; CHMP p. 42) would be amended to recommend that any future railroad track built on restored wetlands in the water-dependent industry area should be constructed to allow for natural movement of water and wildlife beneath or adjacent to the alignment.
- "Subarea Land Use and Transportation Policies, Wetland Subarea, Land Use Policies" (LPP p. 40; CHMP p. 56) would be amended to allow conversion of historic marshlands existing below the current 10-foot contour to their original wetland status or to managed wetlands by raising their elevation using approved dredged sediments.

- "Subarea Land Use and Transportation Policies, Wetland Protection Subarea, Transportation Policies" (LPP p. 40; CHMP p. 56-57) would be amended to require structural solutions to allow for free movement of water and wildlife under any railroad improvements constructed within the existing right-of-way, or within any new right-of-way that traverses wetland restoration areas.
- "Subarea Land Use and Transportation Policies, Western Industrial Subarea, Land Use Policy" (CMHP p. 59) would be amended to add dredged sediment rehandling for on-site and off-site uses as an acceptable water-dependent use in the Western Industrial Subarea.
- "Subarea Land Use and Transportation Policies, Western Industrial Subarea, Development Requirements" (LPP p. 40; CHMP p. 62) would be amended to allow placement of dredged materials for wetland enhancement and restoration, and to protect the completed wetland from future industrial development. Dredged sediment placement should be properly engineered to avoid mudwaves, exposure of contaminants, and similar problems.
- "Subarea Land Use and Transportation Policies, Western Industrial Subarea, Development Requirements" (LPP p. 42; CHMP p. 62) would be amended to provide restored wetlands with the same level of protection from contamination as is currently granted for existing biological habitats. Management and treatment of surface runoff into McDougal Cut, surrounding marshes and the Sacramento River would be subject to federal and state requirements.

4.10.1.2 Solano County Zoning Ordinance

The following amendments are proposed:

- Water-Dependent Industrial (I-WD) District [LPP Section 28-23.3(a), p. 62];(Water-Dependent Industrial (I-WD) District [ZO Section 28-36(a), p. 36.01] would be amended to acknowledge that some lowland areas in the I-WD District have value as wetland habitat or are suitable for wetland restoration.
- Water-Dependent Industrial (I-WD) District [LPP Section 28-23.3(b), p. 62]; Water-Dependent Industrial (I-WD) District [ZO Section 28-36(b), p. 36.01] would be amended to allow wetland restoration using dredged materials as a use requiring a use permit.
- Water-Dependent Industrial (I-WD) District [LPP Section 28-23(b), p. 62]; Water-Dependent Industrial (I-WD) District [ZO Section 28-36(b), p. 36.01] would be amended to allow rehandling of dredged sediments for on-site and off-site use.
- Marsh Protection (MP) District [LPP Section 28-23.6(c), p. 67]; Marsh Preservation (MP) District [ZO Section 28-38(c), p. 38.02], would be amended to allow for restoration of tidal, managed, and seasonal wetlands using dredged materials as a use requiring a use permit.
- Existing agricultural land within the AL-160 Zoning District at the northern end of the property would not be subject to tidal restoration and would remain as upland buffer. As such, no amendment to the AL-160 District is proposed.
- Solano County and BCDC may have to amend their policy language to be consistent with each others policies.. This can be accomplished through coordination between County and BCDC staff prior to the adoption of amendments to County policies.

4.10.2 BCDC Policies and Regulations

BCDC adopted the Suisun Marsh Protection Plan in 1979, pursuant to the Suisun Marsh Preservation Act, enacted by the State legislature in 1977. BCDC adopted the Bay Plan in 1969, pursuant to the McAteer-Petris Act of 1965. As part of the project, the following amendments to the Suisun Marsh Protection Plan and Bay Plan were adopted by BCDC on April 20, 1995. (page numbers in parentheses below refer to the Suisun Marsh Protection Plan). Water-Related Industry Policy 4 (p. 25) was amended to allow placement of dredged materials at Collinsville as long as placement does not adversely affect industrial or port activity. Language allowing the railroad bed dike to be used as a flood control levee was deleted.

- Water-Related Industry Policy 5 (p. 25) was amended to allow the lowland grassland and seasonal marsh at Collinsville to be restored to wetland status using dredged materials.
- Land Use and Marsh Management Policy 12 (p. 29) was amended to allow wetland enhancement at Collinsville through placement of dredged materials.
- The Suisun Marsh Protection Plan Map was amended to allow enhancement or restoration of wetlands.
- The Suisun Marsh Protection Plan Map was revised to identify the restoration of wetlands at Collinsville.
- Bay Plan Map 19 was amended to allow wetland restoration within the Collinsville Port Priority Use Area

Chapter 5
DESCRIPTION OF ALTERNATIVES

■ ■ ■

In addition to the No-Project Alternative, four alternatives to the Proposed Project, including two on-site and two off-site alternatives, were identified for analysis in this EIR/S, as described below. The No-Project Alternative is described at the end of this chapter.

5.1 Alternatives Selection Process

5.1.1 On-Site Alternatives

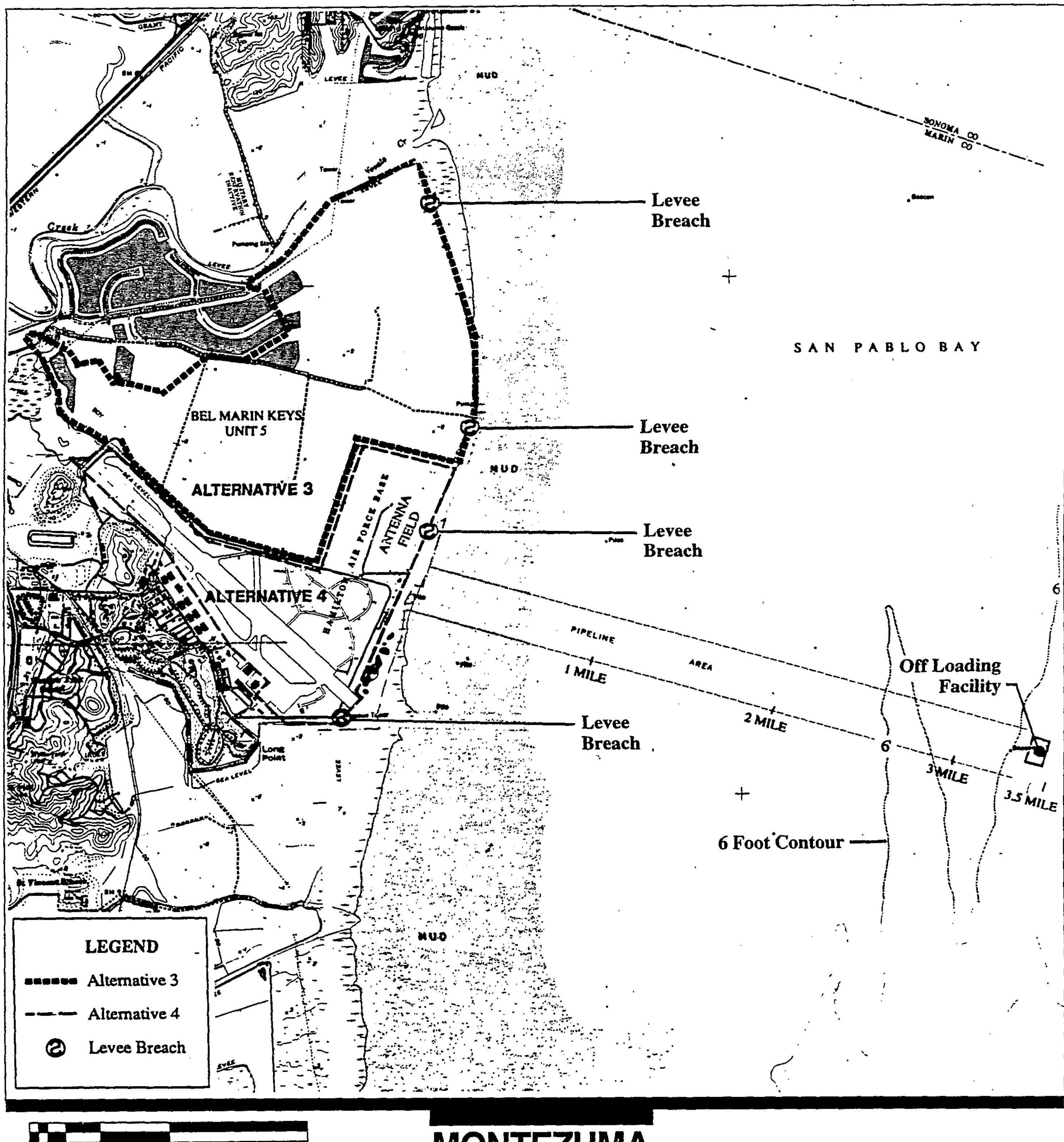
Several on-site alternatives to the Proposed Project were considered during the scoping process by the lead agencies and the agency task force, made up of representatives of regulatory agencies and interested agencies. The effects of using non-cover dredged materials were of concern to the task force, which determined that alternatives should be developed that would reduce potential for release of contaminants into the environment. A managed wetlands alternative and an alternative that combined tidal and managed wetlands were selected to respond to the task force decision. These alternatives are described in this chapter as Alternative 1 and Alternative 2, respectively.

5.1.2 Off-Site Alternatives

In addition to on-site alternatives, a number of off-site alternatives were evaluated. Sixty-eight Bay Area sites evaluated as part of the Long-Term Management Strategy (LTMS) for dredged material disposal in the Bay Area were reviewed to obtain a potential list of other disposal sites suitable for wetlands restoration. The evaluation of the potential list eliminated sites unsuitable for wetlands restoration and sites that did not have the 4 to 5 feet of depth necessary to support the placement of both cover and non-cover material. This alternative screening process is described in more detail in Appendix M.

No viable alternatives were identified in the Suisun Marsh. Sites located farther upstream in the Delta were eliminated for two reasons. While feasible from the standpoint of disposal for dredging projects in the Stockton and Sacramento area, the costs of transporting dredged materials to these more distant sites from the dredging sites in the Bay proved to be too high in comparison with ocean or upland sites closer to the Bay. Also, muds from Bay dredging projects are high in salinity, and disposal in the Delta raised concerns of the Delta water agencies regarding water quality. It is acknowledged that, in the future, salinity and cost-of-transportation concerns may not be insurmountable for Montezuma-type projects in the Delta. Material shortages for levee rehabilitation exist in the Delta, and the use of Bay sediments for this and other beneficial purposes, such as wetland restoration, could be supported in the Delta through the CALFED Bay-Delta Program. To speculate on undefined future projects, however, is outside the scope of this EIR/EIS.

Only three sites remained that met these screening criteria, all in Marin County: Bel Marin Keys, Hamilton airfield, and Hamilton antenna field. For this EIR/EIS, the two Hamilton sites are combined into one off-site alternative. The location of the two off-site alternatives is shown on Figure 5.1-1.



MONTEZUMA WETLANDS PROJECT EIR EIS

Figure 5.1-1

Alternatives 3 and 4: Bel Marin Keys and Hamilton Sites

The two remaining sites were tested against site criteria developed particularly for this project, using and adapting criteria developed through the LTMS, and criteria suggested by state and federal agency representatives on the task force.

The Bel Marin Keys (BMK) site includes the "Unit 5" area of the BMK Master Plan, which amounts to 1,610 acres.[1] Not all of this area is feasible for dredged material disposal and wetland restoration. The northwestern corner, called Headquarters Hill is a naturally elevated upland of about 7 acres that has been partially developed for residential use, and there are about 12.3 acres of existing tidal marsh along the San Pablo Bay and Novato Creek shorelines. Additional acreage (not quantified) consists of perimeter levees that would be modified but left in place to some degree (see below). This EIR/EIS purposely avoids reference to other proposals for the site that are linked to residential development and are the subject of separate actions by the Corps and Marin County. This is to allow an objective evaluation of an MWP-type project at the site without prejudicing other regulatory actions.

The U.S. Army Corps of Engineers, Sacramento District has considered disposal and reuse options, including wetland restoration, for the former Hamilton Airfield.[2] Wetland restoration at Hamilton using dredged material is also being evaluated as a disposal option for sediments from the John F. Baldwin (JFB) navigation channel deepening project[3] and Oakland Harbor Navigation Improvement Project EIR/EIS (in preparation). The Corps, Coastal Conservancy, BCDC, and State Lands Commission and public interest groups are evaluating wetland restoration options that would include the former airfield and the antenna farm.

Both sites are diked, formerly tidal Bay wetlands that have subsided several feet below sea level. Both sites are deep enough to provide a repository for dredged materials which, as at the Montezuma site, would include both non-cover and cover material and be used to re-establish marsh elevations prior to the re-introduction of tidal circulation.

The difference in capacities of the two alternatives as formulated here is due primarily to the acreages available for wetland restoration.

Characteristics of the off-site alternatives are shown in Table 5-1.

In an effort to make wetland restoration at these two sites comparable, to the extent possible, to what is proposed for the Montezuma Wetlands site, the major design elements of the Montezuma Wetlands Project have been incorporated into conceptual designs for the two sites. The conceptual designs include the following elements:

- Phased development of hyrdologically independent subunits that are separately connected to tidal sources (since the two sites are smaller in acreage and have tidal shoreline perimeters (where breaches could be located) that are shorter than the Montezuma Wetlands site, only two phases are considered for each site);

1 LTMS 1996; LSA 1995

2 USACE 1996

3 U.S. Army Corps of Engineers and Contra Costa County 1997

C-088235

Table 5-1
Characteristics of Off-Site Alternatives[a]

Site	*Average Existing Elevation (NGVD)*	*Design Elevation (NGVD) of Restored Marsh Plain*	*Dredged Materials Disposal Area (Acres)*	*Estimated Site Volume (Million Cubic Yards)*	*Off-Loading Constraints*	*Ownership*
Bel Marin Keys	-7.2 feet	+2.0 feet	1,537[b]	17[a]	Off-loading facility to be constructed 3.5 mi. offshore, 3.6 mi. slurry pipeline to pumpout facility at site	
Hamilton	-5.0 feet	+2.0 feet	840	8.7	Off-loading facility to be constructed 3.5 mi. offshore, 4.8 mi. slurry pipeline to pumpout facility at site	Public

Sources: Sources include LTMS (1996), LSA (1995), COE and Solano County (1994), and calculations by SAIC and Moffatt & Nichol for this EIR/EIS.

- Levees defining the location of the tidal channels, the boundary between phases, and sediment placement cells;
- Levee breaches (two for each site; one for each phase);
- Tidal channels that meander around sediment placement cells;
- Sediment placement cells similar in size to those of the Montezuma design and consisting of two types: those containing only cover sediment, and those that would contain a minimum 3-foot layer of cover sediment above non-cover sediment;
- Confinement of non-cover sediment within separation levees incorporating sidewall drain systems and a 200-foot setback from constructed tidal channels as in the Montezuma design;
- Design elevations similar to the low marsh of the Montezuma design, with interior cell levees graded down to the level of the marsh plain except along segments which would be left at the approximate level of MHHW and planted with native marsh vegetation to facilitate sediment deposition by providing breakwaters that limit fetch distances and foster the initial development of high marsh habitat;
- Water management including a make-up water pond that would function as at Montezuma, to assist in slurrying dredged materials and to contain decant water from sediment placement cells for testing prior to discharge to the Bay via a weir, similar to the Montezuma design;
- A sediment handling facility, the purpose of which would be to separate and dry sediments for use in on-site levee construction in the event that not enough material is available on-site. No market for off-site sales is anticipated, so the facility, if needed in the first place, would be removed following construction.
- Sediment testing procedures identical to those of the proposed project

Some of the Montezuma design elements would not be represented at the off-site alternatives, either because they are not needed as mitigation (e.g., for salt marsh harvest mouse mitigation), or because the off-site alternatives do not provide landscape features suitable for these elements (e.g., Clank Hollow).

5.2 Description of Alternatives

This section describes the on- and off-site alternatives to the Montezuma Wetlands Project. The on-site alternatives include a managed wetland (Alternative 1), and a combined tidal and managed wetland (Alternative 2). Bel Marin Keys is identified as Alternative 3 and the Hamilton site is identified as Alternative 4.

5.2.1 Alternative 1: Managed Wetlands

This alternative would create managed wetlands by placing dredged materials in four phases to fill the site behind the existing dikes, as shown in Figure 5.2-1. Tide gates would be constructed in the dikes to allow tidal water to enter the Montezuma Slough. Tidal flow would enter the diked areas at high tides from the Montezuma Slough, creating ponds. The tidal flow would be controlled according to schedules designed to encourage growth of specific types of vegetation. The primary objective of this water management strategy would be to generate food production for waterfowl, shorebirds or other wildlife.

5.2.1.1 Facilities

Construction and operation of the off-loading facility and maintenance and monitoring would be the same as in the Proposed Project. Like the Proposed Project, Alternative 1 would include improvements to the DWR day use facility and construction of a new public access facility.

5.2.1.2 Wetlands Restoration

Alternative 1 would involve the creation of a managed wetlands generally similar in form and function to the managed wetlands throughout Suisun Marsh. The sediment would be pumped through the transport pipeline to the cells and deposited in layers, or lifts. Non-cover material would be covered by a layer of cover material. Water would be decanted off the cells into holding ponds and channels before a subsequent lift of sediment would be placed. The placement and draining operation in each cell would continue until a target elevation is reached. Several cells would be operating simultaneously to allow for disposal of a large quantity of sediments at the same time and for flexibility in receiving and placing cover and non-cover sediments.

5.2.1.3 Operation

The design of the managed wetland includes four different water management schedules that are currently utilized for the majority of the managed wetlands in Suisun Bay. The four basic water management schedules proposed as part of the non-tidal managed wetlands alternative include the Fat-Hen, Alkali Bulrush, Permanent Ponds and Watergrass Management. These schedules have been developed by the California Department of Fish and Game (CDFG), Natural Resource Conservation Service (NRCS), Solano County Mosquito Abatement District (SCMAD), and Suisun Resource Conservation District (SRCD). Variations on these management schedules to benefit a wider range of wildlife would be possible in this alternative; for example, partly bare saline basins could be managed for shorebird use.

- *Fat-Hen*. The Fat-Hen schedule, which requires drawdown of tidal water early in the year, would encourage the growth of fat hen (*Atriplex triangularis*), pickleweed (*Salicornia virginica*), brass buttons (*Cotula coronopifolia*) and saltgrass (*Distichlis spicata*).
- *Alkali Brush*. The Alkali Bulrush (*Scirpus robustus*) schedule would encourage alkali bulrush growth, with a greater potential for cattail and tule encroachment. This schedule requires late drawdown of tidal water into the wetlands.
- *Permanent Ponds*. Managing for permanent ponds involves flooding year round. These managed wetlands tend to develop cattail and tule growth in the shallower areas, and pondweeds in the deeper, open-water areas.
- *Watergrass*. Managing for watergrass (*Echinochloa* spp.) for production of waterfowl food requires controlled summer irrigation, planting, very good water quality, and rapid flooding and draining.

All four model schedules incorporate at least fall and winter flooding to provide food sources for migrating water birds. The spring water level affects growth of pickleweed, fat-hen, and brass buttons on the higher margins of the ponds. More than one of these schedules may be suitable for a particular management unit, in which case flooding practices would be alternated every few years to promote diversity.

Drainage from the cells in all four schedules would be accomplished primarily by gravity because of the relatively high final cell elevations. Cells located adjacent to the uplands would be constructed with oversize drain facilities to accommodate excess runoff. Water control structures would consist mainly of culverts with flap gates or sliding gates, manually operated, to control flow.

5.2.1.4 Salt Marsh Harvest Mouse (SMHM) Habitat Mitigation Plan

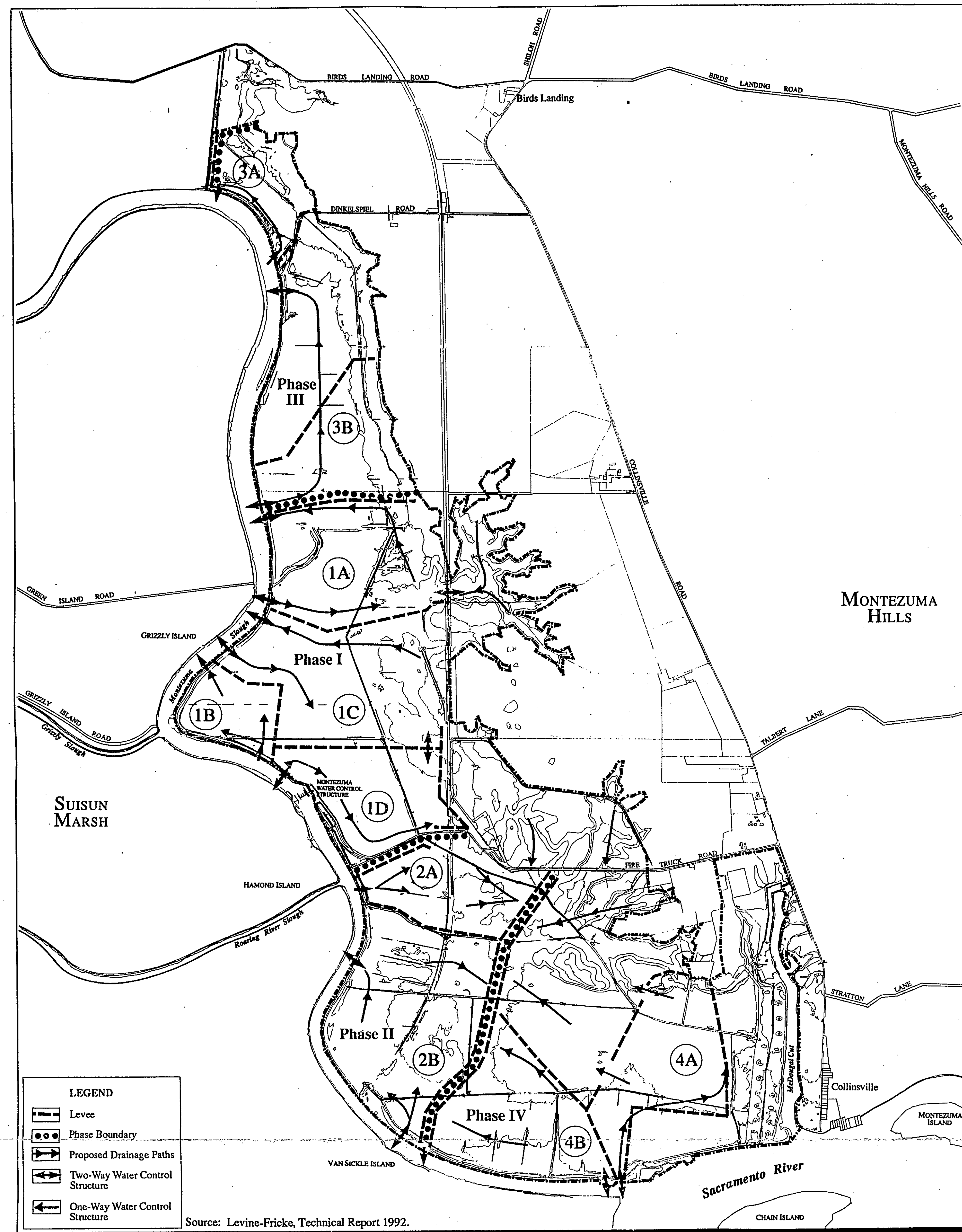
The SMHM Habitat Mitigation Plan developed for the Proposed Project would be part of this alternative. SMHM habitat could be created in any of the four phases by filling and managing for pickleweed, instead of the vegetation prescribed by the individual schedules. The feasibility of creating or enhancing SMHM habitat in this manner this has been demonstrated at Simmonds Island, where managing for pickleweed led to the development of high-quality habitat in less than 10 years.[4]

5.2.2 Alternative 2: Combined Tidal Wetlands

Alternative 2 would include the restoration of tidal wetlands in the same area shown as Phases II and IV of the Proposed Project, which are the phases closest to the Sacramento River, and the creation of managed wetlands in the Phases I and III areas. In Phases II and IV, levee construction, channel construction and sediment placement would be the same as in the Proposed Project. In Phases I and III, the ponds would have the same management schedules described in Alternative 1.

The flooding and drainage systems, water control structures and operation would be the same as Alternative 1. Construction and operations, post-construction maintenance and monitoring, and public access facilities would also be the same as in the Proposed Project.

4 Personal communication, P. Baye



MONTEZUMA WETLANDS

P R O J E C T

EIR EIS

Figure 5.2-1

Alternative 1: Managed Wetlands

N

0' 950' 1900' 3800'

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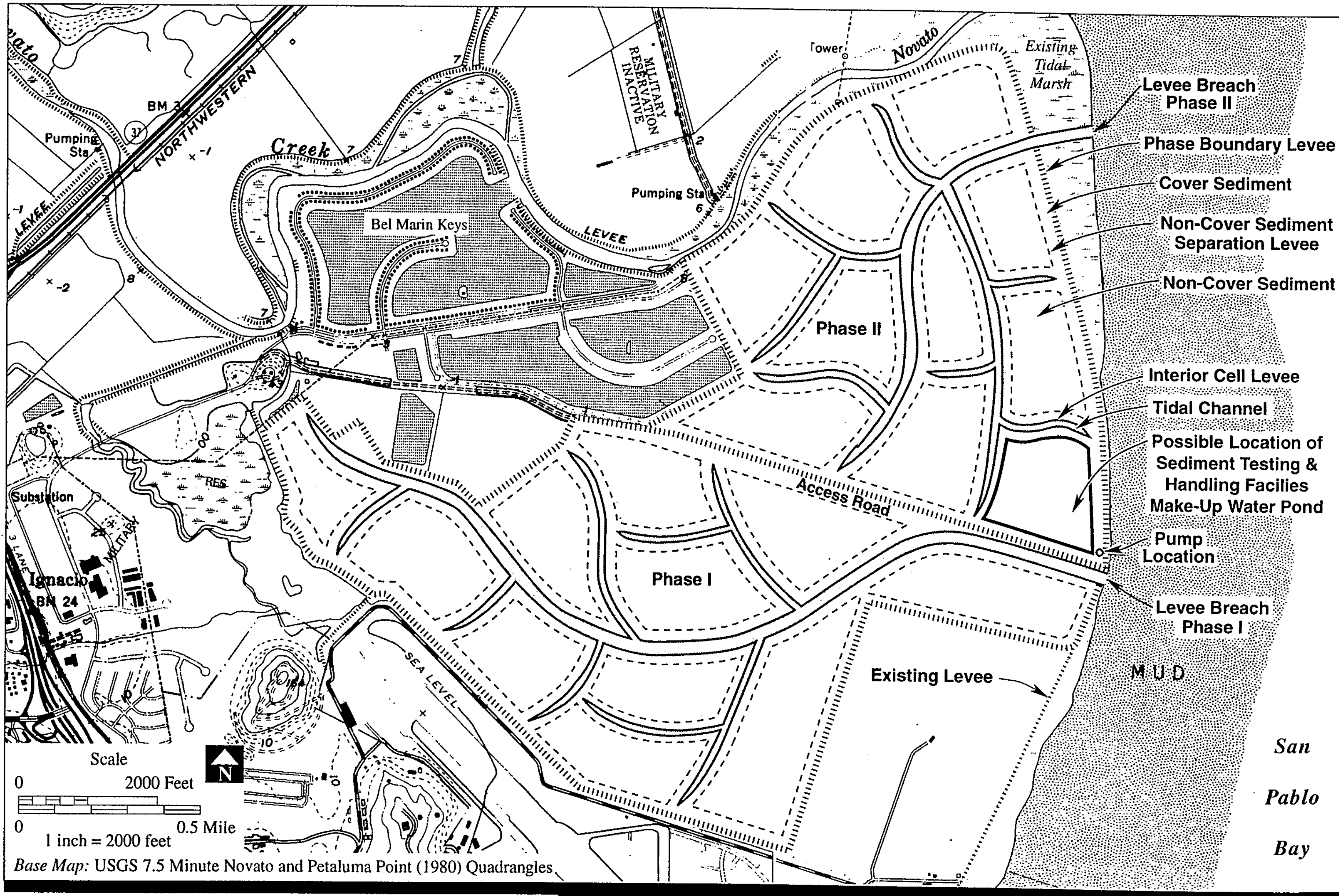

MONTEZUMA WETLANDS PROJECT
EIR EIS

Figure 5.2-2

Bel Marin Keys Alternative – Conceptual Site Plan

C—088240

As for Alternative 1, the SMHM Habitat Mitigation Plan developed for the Proposed Project would be part of this alternative. The managed wetlands area could be managed for pickleweed growth that is expected to support SMHM habitat.

5.2.3 Alternative 3: The Bel Marin Keys Site

The Bel Marin Keys site is located in an unincorporated area of northeastern Marin County. It is bounded to the west by the existing Bel Marin Keys Units 1-4 residential development. It is bounded by Novato Creek to the north, San Pablo Bay to the east, and to the south by the Hamilton antenna field and the abandoned airfield (see Figure 5.2-2).

Road access to the site is by way of Bel Marin Keys Boulevard. Water access from San Pablo Bay is precluded by the shallow mudflats that extend well into the Bay. The transfer of dredged material from vessels moored in San Pablo Bay is feasible using slurry pumping methods.

A rough estimate is that the site has a capacity of approximately 17 million cubic yards. At this conceptual design level, capacity is roughly equal to that of the Montezuma site, and would be subject to change in a more detailed design. The site is closer to central Bay dredging sites, about 6 to 8 hours by barge compared to about 13 hours to the Montezuma site. A Montezuma-like design for wetland restoration is shown in Figure 5.2-2.

5.2.3.1 Site Characterization

In the late 1800s through the early 1900s, the marsh lands on the site were diked in two phases to accommodate dry land farming. First, existing marsh was diked and reclaimed for agriculture. New marsh that programmed over mudflats outboard of the new dike was subsequently diked and also reclaimed. A system of levees and drainage ditches were constructed and pumps were installed to drain rainwater and the naturally high water table. Over the intervening century, oxidation, consolidation, and subsidence of the bay mud substrate occurred. As a result, the former tidal baylands have subsided to an average of 7 feet below sea level. In the 1960s, Units 1 through 4 of the Bel Marin Keys residential development were constructed. Fill for the development was taken from borrow pits on the Unit 5 project site. These borrow pits have become brackish ponds.

Currently, most of the site is farmed for oat hay. Extensive areas of the hayfield are shallowly inundated as a result of winter rains, with the duration and depth of ponding proportional to rainfall. Tens to hundreds of acres may be inundated for days to months in any given year (personal communication, P. Baye). LSA[5] indicates that extreme flooding events result in ponding over at 755 acres of the hayfield portions of the site, with an additional 41 acres consisting of ditches and ponds (former borrow pits). The Corps of Engineers San Francisco District Regulatory Branch is currently determining the extent of section 404 jurisdictional wetlands and other waters of the U.S. on the site (personal communication, P. Straub). Much of the seasonally flooded area may qualify as prior-converted cropland and therefore be exempt from regulation under section 404. A band of variable width of tidal marsh and extensive mudflats lies bayward of the levees. In addition, the site contains a small upland area, Headquarters Hill, which was historically vegetated in oak woodland. Five permanent and two temporary residences have since been constructed on the hill, removing most of the former natural habitat.

5 LSA 1995.

5.2.3.2 *Facilities*

An off-shore unloading and pumping facility and a submerged pipeline would transport dredged materials to the site. A pile-mounted platform would be constructed in the Bay to moor a barge and transfer the dredged materials to a pipeline originating at a pumpout facility located approximately 3.6 miles offshore from the Hamilton site, at the 12-foot contour interval, a depth sufficient to accommodate small-to-medium size barges. The barge mooring facility would include mooring dolphins (a pile, a cluster of piles, or a buoy, to which a vessel may be moored in open water) to tie the barge, a water pump to transform thesediment into a mixture of mud and salt water from San Pablo Bay (slurry), a dredge pump to empty the barge, a main 20-inch discharge pipeline to transport the slurry to the disposal site. Water from the Bay would be used for slurry.

Dredged materials would be hydraulically pumped to onshore disposal areas through the underwater slurry pipeline. The pipeline would make landfall at the Hamilton site and then proceed north along the existing eastern perimeter levee at Hamilton until it reaches the Bel Marin Keys site. A 3- to 4-foot trestle may have to be constructed through the marsh. Low ground pressure construction equipment (e.g., pile drivers) would construct this trestle.[6] Some short-term impacts would be likely due to this construction.

A diesel-fueled booster pump at the shoreline would convey the slurry from the 20-inch main discharge pipeline to branch lines with valve assemblies, to distribute slurry to the active disposal cells. Given the distances that the slurry must be pumped, 1-2 additional booster pumps are likely to be necessary to distribute the slurry. Prior to disposal operations, containment levees would be constructed around cells, using sediments excavated from the site and, if on-site material is insufficient, from a rehandling facility that would be constructed as needed to provide adequate material for levees. Typical dikes would have a top width of 10 feet and side slopes of up to 2 horizontal:1 vertical.

A water management system, similar to that of Montezuma, for use during construction would be included. This system would include a return-water channel and make-up water pond. The pond would function both to contain decant water prior to discharge via a return water pipeline to deep water in the Bay, and to provide additional water as needed to slurry dredged material. A construction trailer, field office, and laboratory facilities would be located adjacent to the off-loading facility operation, as would the make-up water pond and rehandling facility. A suitable location suggested for these facilities is adjacent to the bayfront levee near the boundary between phase I and II (Figure 5.2-2). Assuming a Montezuma-like design, these facilities would occupy about 80 acres. Some of the diked lowland areas would have to be filled to support structures and access above seasonal and tidal flooding elevations, presumably to about 8 feet MSL. The extent of fill in potential wetlands would be minimized by siting buildings and access on existing levees.

An access trail along the levees to a point access area would be provided under this alternative.

5.2.3.3 *Wetlands Restoration*

Dredged materials from various parts of the Bay would be deposited at the site with the objective of restoring tidal wetlands, and to promote both pickleweed and cordgrass tidal marsh associations. Both cover and non-cover materials would be used. Confirmation of sediment testing results during ongoing sediment placement activities would be done similar to that proposed for the Project. Dredged material would be placed into sediment containment cells to achieve a design elevation of approximately +2.0 feet

6 . Personal communication, Dilip Trivedi 1996

NGVD, allowing as in the Proposed Project for the initial establishment of low marsh which, at this site, would be dominated by cordgrass. Then the restoration site would be opened to tidal influence, allowing additional deposition of sediment carried by the Bay waters.[7] Levee slopes would provide high marsh and upland transition habitats.

Tidal action would be initiated through simple breaches in the bayside levee, one in the southeast corner and one in the northeast corner of the site. Tidal stream channels would be designed using the same criteria that would be applied to the Montezuma site. Third, fourth, and fifth-order channels would be engineered utilizing cell levees (i.e., the cell levees would define these channels). Natural sedimentation and erosion would establish the final marsh plain, and would differentiate eventually the high and low marsh.

High levels of suspended sediment in San Pablo Bay would result in a naturally high sedimentation rate at the site,[8] with elevations in portions of the site naturally increasing from low marsh to high marsh over several years. For this reason, there would be no reason to engineer high marsh habitat at Bel Marin Keys, other than providing initial elevations for high marsh along the levee slopes.

Engineering—including elevation controls and water and sediment handling procedures similar to those designed for Montezuma (Chapter 4) would have to be incorporated into this alternative.

Tidal Source

The tidal source for this site is San Pablo Bay. Tidal levels at this site are relevant for planning water access, levee heights, and effluent water discharge operations. The nearest tidal bench mark to this site is NOAA Station 941-5252 located at Petaluma Point. At this bench mark, MLLW is 2.65 feet below NGVD.[9] Elevations of tidal datums referenced to MLLW and NGVD at Petaluma Point are shown in Table 5-2.[9]

Table 5-2
Tidal Datum Elevations at Petaluma Point

Tidal Datum	*Elevation (Ft. MLLW)*	*Elevation (Ft. NGVD 1929)*
Mean Higher High Water (MHHW)	5.93	3.28
Mean High Water (MHW)	5.36	2.71
Mean Tidal Level (MTL)	3.17	0.52
NGVD	2.65	0.0
Mean Low Water (MLW)	0.99	-1.66
Mean Lower Low Water (MLLW)	0.00	-2.65

Biological Habitats

Except for the western levee between the residential development and lagoons and the tidal restoration site, the entire restoration area would ultimately be restored to tidal salt marsh. LSA's[10] conceptual plan

7 LSA 1995
8 Krone & Associates 1996
9 NOAA 1980
10 LSA 1995

identifies high marsh, low marsh, mudflat, channel, and open water habitats as part of the restored wetland. For comparison with Montezuma, this analysis assumes that channels would be engineered along the banks of cell levees and would provide areas of shallow water, and marginal areas of low-intertidal mudflat grading into low marsh dominated by cordgrass. Small channels could be allowed to erode naturally, but the same criteria mandating the isolation of non-cover material at Montezuma would apply here, precluding significant erosion beyond the 200-foot setback. Whereas the initial elevation of the marsh plain at +2 feet NGVD should be conducive to cordgrass, sedimentation is expected to rapidly elevate the marsh plain to levels at which pickleweed would become dominant.[11] As a result, most of the low, cordgrass marsh is expected to undergo succession to pickleweed, leaving cordgrass primarily as a fringe along the low channel banks. Levee banks would support high marsh and upland transition vegetation.

Levees

The existing outboard levee at the site is at approximately +6.5 feet NGVD and would be maintained during construction phases. This should be adequate as the estimated Federal Emergency Management Agency (FEMA) tidal-flooding elevations are +6.0 feet NGVD for the 10-year event and +7.0 feet NGVD for the 100-year event. Levees that protect existing developed areas that are currently protected by the bayfront levee should be built up to provide flood protection, to an elevation of +12 feet NGVD at the crest, with a gentle outboard slope of 10:1.

The tidal restoration area would be hydrologically separated from the development to the west by the western levee. Initially, the other perimeter levees would be maintained as necessary to contain dredged material. After enough dredged material has been deposited to reach desired elevations, the levee separating the restoration area from the Bay would be breached at selected locations to provide tidal action to the site (two levee breaches are assumed for this analysis). These peripheral levees would not be maintained. Over time, they would continue to subside and erode, and would eventually breach and/or be overtopped by high tides.

The cells would be surrounded by levees, constructed out of the material scraped from the existing fields. These levees would be built to an elevation of +4 feet NGVD. All levees would have flat crowns 10 feet wide to allow temporary vehicle access during the construction period. The levees would serve to create temporary basins into which dredged materials would be deposited. It is assumed, as at Montezuma, that most of the levees would be graded down to marsh plain elevations prior to the introduction of tidal flows.

Public Access

An all-weather security road would be constructed on top of the western levee. Only authorized personnel would be allowed vehicular access to the levee road, which would be through a locked gate at the east end of one of the BMK Unit 5 spur roads off the loop road in the residential development.

Recreational access by pedestrians, joggers, and bicyclists would be allowed on the levee, but not in the restored salt marsh. The levee road would be posted with educational signs informing people that the marsh is for wildlife only and a barrier fence would be constructed. The levee road would then serve as shoreline access for people and as a wildlife viewing area, while preserving the marsh proper as an exclusive habitat area.

11 Krone & Associates 1996

5.2.3.4 Operation

Other operations related to placement of sediment, and post-construction maintenance and monitoring would be generally the same as for the Proposed Project, except insofar as there would be no off-site sales associated with rehandling facility operations. Since the capacity of the site would be similar to that of the Montezuma site, it is expected that the life of the project would be similar to what is anticipated for the Project. The number of workers involved in constructing the facilities and in the sediment disposal operations is also expected to be slightly less than the 20 to 46 employees expected for the Project, because of the slightly smaller acreage of the site and the absence of a off-site sales of rehandled sediments.

5.2.4 Alternative 4: The Hamilton Site

The Hamilton site includes the former Hamilton Airfield, which occupies approximately 600acres of the former 1,600-acre Hamilton Air Force Base, and the adjacent antenna field, which consists of about 240 acres of grassland habitat. Located in the City of Novato in Marin County, the site is bounded on the north by the Bel Marin Keys site (Alternative 3), on the east by San Pablo Bay, on the south and west by the St. Vincent's Catholic Youth Organization property and areas formerly occupied by facilities of the Hamilton Army Airfield (see Figure 5.2-3). Ownership of the former airfield is currently in the process of being transferred from the federal government to other public and/or entities. Restoration and conveyance of the property are scheduled to occur by the year 2000.

Dredged material disposal and wetland creation at this site would be generally consistent with the design of the Proposed Project, similar to what is envisioned at the BMK site. Engineering—including elevation controls and water and sediment handling procedures similar to those designed for Montezuma (Chapter 4) would have to be incorporated into this alternative.

5.2.4.1 Site Characterization

Historically within the tidal zone of San Pablo Bay, the site includes low elevation areas that were once marshland and are now protected from inundation by a series of levees and pumps. The portion of the abandoned airfield that could be used for disposal/restoration purposes contains an 8,000-foot-long runway (oriented in a northwest to southeast direction), associated aircraft parking areas and taxiways, graded areas where old facilities have been demolished, and several large pumping stations located just inboard of the San Pablo Bay perimeter levee. Most of the infrastructure adjacent to the site is in poor condition, but is expected to be upgraded as part of the redevelopment of former Army property. As part of contamination remediation, a 20-acre borrow pit has been excavated and is subject to ponding. This pit would be refilled upon completion of the remediation effort. An additional area of about 20-acres has been scraped and is subject to seasonal ponding. The airfield has contamination which would be remediated by burial under dredged materials.

The antenna field is separated from the airfield by a levee and includes abandoned communications facilities but is otherwise grassland that is subject to agricultural use. The site is also used as a pistol range by the Novato Police Department. As envisioned here, Phase I of the restoration project would occupy the former airfield, and Phase II would be constructed on the antenna field.

The site is readily accessible from U.S. Highway 101 via a frontage road and two entrance gates. The Northwestern Pacific Railroad crosses the western portion of Hamilton Army Air Base. Like the Bel Marin Keys site, water access from San Pablo Bay is precluded by the shallow mudflats which extend well into the Bay. The transfer of dredged material from vessels moored in San Pablo Bay is feasible using slurry pumping methods.

The Department of Defense owns about two-thirds of the base (1,210 acres of the approximately 1,600-acre base), which has been idle for more than 20 years, although the airfield was still used until recently by military helicopters.[12] The 1,210 acres includes a 700-acre runway; housing and other base facilities comprise approximately 510 acres. The site has been offered to the City of Novato, which is not interested in acquiring the site because of the costs associated with maintaining the levees and associated pumping facilities. The City of Novato would be interested in taking control of the site after conversion to tidal wetlands which would alleviate the concerns surrounding pumping and extensive levee maintenance.[13]

The Corps, Sacramento District has constructed a 20-acre seasonal freshwater wetland on the northern portion of the runway to mitigate for wetlands lost elsewhere on the site.[14] This mitigation site was constructed so as to overflow into existing drainage culverts.[13]

A buried jet fuel pipeline crosses the upper part of the runway and extends southeastward closely paralleling the levee that separates the antenna field from the airfield. The pipeline extends 18,000 feet offshore into San Pablo Bay.

The average elevation of the airfield is -5 to -6 feet NGVD, and the antenna field is approximately the same. Assuming a +2-foot finished elevation, the capacity of the Hamilton site is approximately 8.7 mcy of dredged material (see Table 5-1), roughly half that of the Proposed Project. The site is closer to central Bay dredging sites, about 6 to 8 hours by barge compared to about 13 hours to the Montezuma site.

There is contaminated soil on site. The types of contamination include fuel-contaminated soil and rock, total petroleum hydrocarbons or "TPH" (including diesel fuel, kerosene, jet fuel, C11-C20 hydrocarbons), volatiles, semi-volatiles, lead, metals, pesticides, and PCBs.[15] Contaminated soils are being remediated on the site as of mid-1997. Residual areas of contamination, e.g., under the runway, can be left in place and contained through burial by dredged materials.

Generally, the value of the airfield portion of the site as habitat for wildlife is low. Most areas that are not concrete, asphalt, or recently excavated support non-native annual grassland vegetation, some of which provides seasonal wetland habitat. Additional areas of wetland habitat (jurisdictional status has not been confirmed) within the airfield includes the mitigation site and the excavated and scraped areas mentioned previously, as well as ditches and a few stands of seasonally wet grassland.[13] From the bayside levee crest seaward, an area that would not be filled, high, middle, and low marsh communities descend to the mudflats of the bay. The adjacent antenna field consists of grassland, much of which is seasonally inundated and provides seasonal wetland habitat values. Various raptors, including barn owls, golden eagles, redtailed hawks, and red-shouldered hawks have been observed foraging for small mammals in the area. Gray foxes also may hunt for prey among the small rodent populations on the site. Tidal wetlands outside the perimeter levees on the east side of the site support wetland species and shorebirds and are part of the San Pablo Bay National Wildlife Refuge.[13]

12 LSA 1995
13 LTMS 1995
14 Personal communication, Bob Koenigs 1996, USACE
15 U.S. Army Corps of Engineers 1996

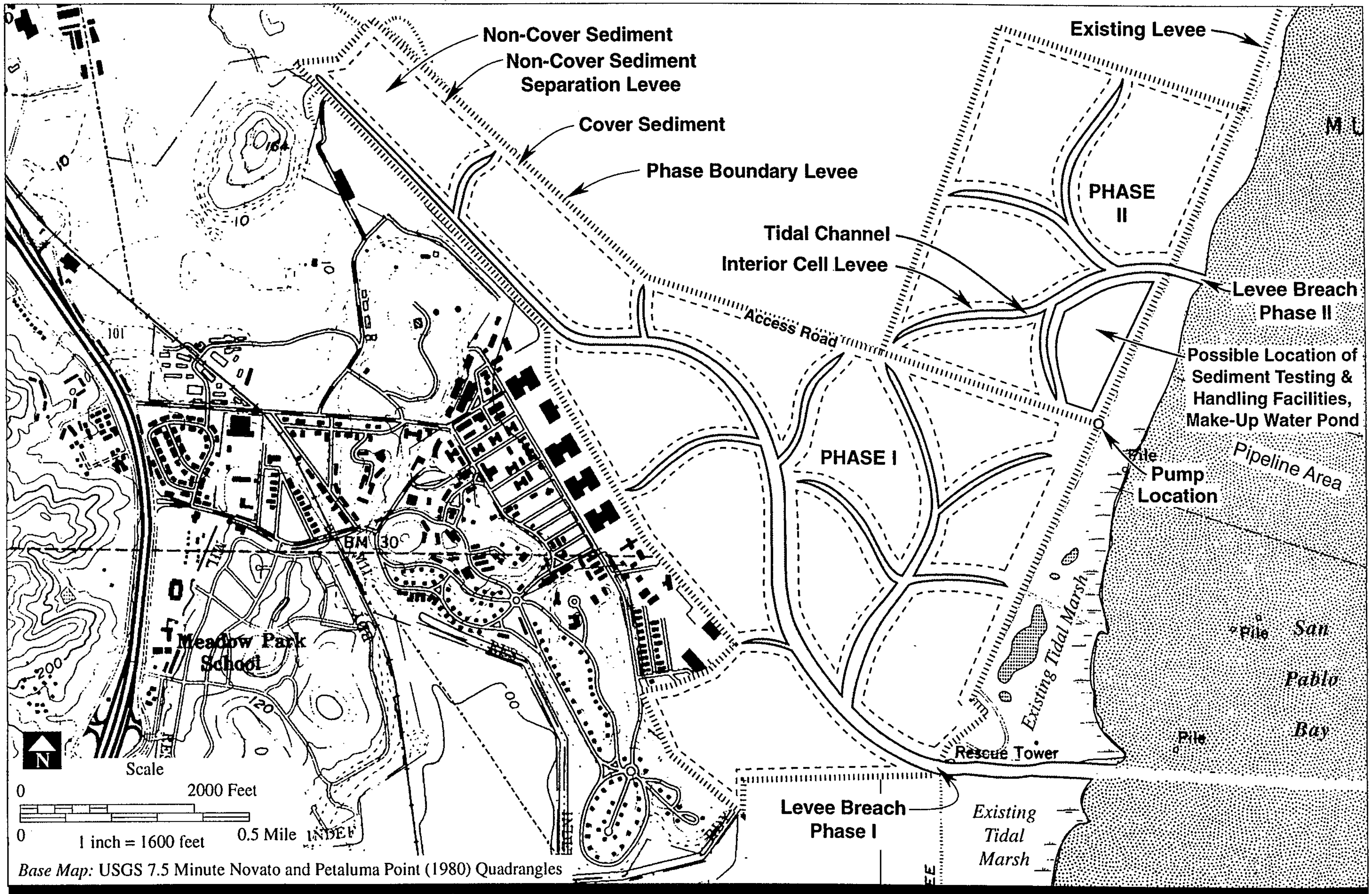

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Figure 5.2-3

Hamilton Army Airfield Alternative – Conceptual Site Plan

No site-specific assessments have been completed for special status plants or animals on the Hamilton site. It is unlikely that threatened or endangered species occur within the diked grasslands and disturbed areas that would be filled, although habitat for several listed species occurs in the tidal wetlands of the National Wildlife Refuge.[13] The only special status species known to have occurred at the site is the burrowing owl, which nested along the edges of the runway and along the levees at the airfield; the current status of these owls given the recent cleanup activities is unknown. The site also contains wetland and upland areas that provide habitats for shorebirds, raptors, and mammals.

Successful tidal marsh restoration at this site would replace existing grasslands, seasonal wetlands, and disturbed sites with approximately 840 acres of tidal marsh and channel habitats and adjacent upland-wetland transition zones along levee slopes. This would be of great benefit to endangered salt marsh species (salt marsh harvest mouse and California clapper rail) that inhabit what is now the narrow fringe of tidal marsh along the San Pablo Bay shoreline. Restoration of these sites would provide an expanded dispersal corridor connecting to Petaluma River marsh populations.

Since the airfield is within the Novato city limits, it is subject to the City of Novato General Plan and zoning designations. No General Plan land use designation has been assigned to the property. Rather, after consideration of extensive studies, the City of Novato has incorporated a series of recommendations for the ultimate use of the airfield into its General Plan. Instead of designating specific areas of the airfield for particular uses, the General Plan adds a set of overall criteria to the recommendations for use in evaluating proposals for the property. Within this context, the General Plan indicates that open space, wetland restoration, and flood control uses would be appropriate in the lowland areas. The General Plan also notes that lowlands within the existing diked area would be appropriately used for grazing and foraging production, and possibly for production of agricultural crops. The entire area of HAAF is currently zoned Planned Community (PC) by the City of Novato, and is not under Williamson Act contract.[13]

Hamilton Army Airfield was formerly designated as an Airport Priority Use Area in BCDC's *San Francisco Bay Plan*. This designation was changed to Wildlife Refuge Priority Use Area in November 1995, and BCDC's new policy is that dredged material should be used for wetland restoration on the site if possible.[16]

5.2.4.2 Facilities

The same types of facilities described for Alternative 3 could also be used for this alternative. The off-shore unloading and pumping facility would be the same for this alternative, although the transport pipeline carrying slurry to the site would be about 8,000 feet shorter than that for Alternative 3. The barge would be located 3.6 miles offshore (at the 12-foot contour) in San Pablo Bay. Similar to Montezuma, the operation of 1-2 diesel-fueled booster pumps on the site would be necessary to transport the slurry to desired locations.

Like Alternative 3, provision is included for sediment handling facilities and a make-up water pond similar to the make-up water pond proposed for the Project but making use of water from the bay. The make-up water pond would contain decant water from sediment placement cells and allow testing prior to discharge in deep water via a return water pipeline. A construction trailer, office, and laboratory facilities could be located on the same part of the site. A suitable location for these facilities would be on the inboard side of the bayfront levee at the suggested pump location between phases I and II (Figure 5.2-3), where use could

16 Personal communication, E. Larson, BCDC

be made of existing and newly constructed levees for access, as well as old ditches and pumping facilities. With a Montezuma-type design, these facilities would occupy a total of about 80 acres, portions of which would require filling to support structures above seasonal and tidal flooding elevations, i.e., to about 10 feet MSL.

The Martin Group, a residential developer, is developing some of the upland portions of Hamilton, and a 7,000-foot inboard levee that is aligned northwest to southeast, adjacent to and west of the runway. The levee extends most of the length of the western boundary of the runway and is built to withstand a 100-year tidal event.

For habitat development, the levees must withstand a 10-year tidal event, that is, one that is reasonably expected to occur during the construction of the project. FEMA flood hazard data indicate that for this site, flood levels are essentially equivalent to tidal levels, that is, the major flood events are associated with extreme high tides. The 10-year tide for the site is given as +6.0 feet NGVD, and the 100-year event as +7.0 feet NGVD.[17] The existing outboard levee heights are approximately +6.5 feet NGVD, and the inboard levees are approximately +3.0 feet NGVD.

It is assumed that the existing bayfront levee would be maintained or reinforced as minimally necessary to provide adequate protection from tidal flooding during wetland construction. As at Montezuma, this levee would be allowed to degrade subsequently. The levees along the northern boundary of the site would need to be constructed to a height of 12 feet NGVD to provide flood protection for contiguous properties, and should be gradually sloped at 10H:1V inward to provide a gradual transition to intertidal habitats. Following construction, the outer levee would not be maintained, and as it would subside and erode over time, it would eventually be overtopped by high tides and breached.

This scenario assumes that the existing levee system adjacent to San Pablo Bay would be breached (two levee breaches, one for each phase, are assumed for this conceptual design), allowing Bay tidal flows to inundate first the airfield parcel, and then the antenna field. The existing wetland mitigation site at the northwest end of the airfield could be incorporated into the design, e.g., as an intertidal pond fronted by a low berm, or it could be separated from restored tidal wetlands by a levee and maintained as a freshwater wetland. In the latter case, installation of pumps would be required to pump fresh water over the levee into the Bay. This detail could be addressed in the final design and does not affect this analysis.

Engineering, including elevation controls and water and sediment handling procedures similar to those designed for Montezuma (Chapter 4), would have to be incorporated into this alternative. At present, all drainage on the site is collected by a series of culverts which are pumped by several large pumping stations to San Pablo Bay.[18]

Public access would be provided along the perimeter road that surrounds the airstrip and along the levees to a point access area.

5.2.4.3 Wetlands Restoration

Dredged materials from various parts of San Francisco Bay would be disposed at the Hamilton site in the same manner as that described for Alternative 3, with the objective of restoring salt marsh similar to existing mudflat-cordgrass-pickleweed salt marsh around the edge of the Bay. Levee breaches would be

17 FEMA 1989
18 LTMS 1995

used to initiate tidal circulation. Both cover and non-cover materials would be used. Confirmation of sediment testing results during ongoing sediment placement activities would be done similar to that proposed for the Project. Vegetation would be established through natural processes. The project would be constructed in two phases, like Alternative 3. This alternative would have the same tidal source as Alternative 3. In other respects, restoration design would be similar to that described for Alternative 3.

The existing saltwater marsh seaward of the airfield would remain protected by the existing levee that runs along the southeastern border of the site.

The two proposed levee breaches have been located to minimize impacts on existing high marsh habitat. Naturally high sedimentation rates would be expected at this site, like the Bel Marin Keys site,[19] resulting in elevation changes over portions of the site from low marsh to high marsh in several years. There would thus be no need to engineer high marsh habitat as part of the wetland design, although levee slopes would provide appropriate initial elevations for high marsh.

Depending on the exact layout of the wetland, numerous heavy concrete structures, including the pump stations, may need to be demolished or protected by a new levee system prior to initiating filling of the site. The existing runway would not be excavated prior to placement of dredged material. Placement of dredged material and the eventual accretion of silt resulting from tidal action would total 8 to 9 feet.[20] It is not anticipated that there would be any significant impact to drainage or wetland plant survival as a result of leaving the runway in place.[18]

5.2.4.4 Operation

The operations, maintenance, and monitoring for this alternative would be the same as for Alternative 3. However, since the area considered for restoration would be smaller than at both Bel Marin Keys and the Montezuma site, and the volume of dredged material substantially less, it is expected that the life of the project would be the shortest for this alternative. The number of workers involved in constructing the facilities and in the sediment disposal operations is also expected to be less than the 20 to 46 employees expected for the Project, for the same reason.

5.2.5 The No-Project Alternative

Under the No-Project Alternative, the Montezuma site would not be used for disposal of dredged material and the site's historic wetlands would remain unrestored. The site would continue in grazing use as seasonal wetlands and uplands.

This alternative does not necessarily mean that no change would occur at the site. Without the project, the existing perimeter levee could fail, resulting in a large tract of shallow water habitat. With an average subsidence rate of 1.5 inches per year, the potential for levee failure increases each year. (Levee failure, which has occurred on nearby Delta islands due, in part, to poor levee maintenance, has resulted in flooding of the entire island, and levee failures at South Bay salt ponds have eventually produced emergent vegetation.) A levee failure at the project site under this alternative would not require the land owner to mitigate for the loss of existing wetland habitat that would result. Natural sedimentation would eventually re-establish intertidal elevations, probably within 25-50 years.

19 Krone & Associates 1996
20 Personal communication, D. Trivedi 1996, Moffatt & Nichol

Under this alternative, there would also continue to be a shortage of appropriate and cost-effective disposal sites for non-cover sediments, making their excavation and disposal more costly, though not prohibitively expensive based on recent EIS/EIRs for dredging projects in the Ports of Oakland and Richmond. Other sites identified in the LTMS studies would continue to be candidates for disposal of dredged materials.

The CALFED Bay-Delta Program indicates a heavy demand for sediments that can be used for levee rehabilitation in the Delta. Under the No-Action alternative, this demand would remain, and it is likely that a rehandling facility would be developed somewhere else, probably in the western Delta, to rehandle Bay sediments.