PROJECT SUMMARY
INTERIM NORTH DELTA PROGRAM

CONTENTS

D-002846

Project Purposes

The purposes of the Interim North Delta Program are to improve State Water Project reliability through reduction in reverse flow and to improve flood protection in the lower Mokelumne River system .

Potential additional benefits of implementing the program include improved water quality, reduced fishery impacts, greater SWP operational flexiblity, enhanced recreational opportunities, and improved wildlife habitat.

Background

The Draft EIR/EIS for the North Delta Program was released in November 1990. Since that time the Department has conducted additional studies and taken actions in response to comments received after release of the document.

Major studies were conducted to provide more detailed evaluations of:

- o Seepage monitoring,
- o Scour and sedimentation monitoring,
- o Jurisdictional wetlands,
- o Archaeological resources,
- o Sensitive species,
- o Toxic materials concentrations in channel sediments and adjacent soils,
- o Wildlife habitat,
- o Fisheries impacts reduction and enhancement measures,
- o Prime and unique soils,
- o Geologic conditions along the North Mokelumne River,
- o Delta sedimentation and turbidity,

o Flood hydrology,

o Low flow hydrodynamics and water quality,

o Topography along the affected channels and sloughs, and

o Recreation opportunities and impacts.

These studies are expected to be completed in Calendar Year 1995 or are well established to collect long-term base line data.

The Department purchased the 480 acre Grizzly Slough Mitigation/Borrow site in 1992 to provide an established site for project mitigation needs and borrow materials for levee improvements.

The Department has initiated and supported several efforts to reduce fisheries impacts associated with diversions of water from the Sacramento River through the Delta Cross Channel, Georgiana Slough, and Threemile Slough. Among these efforts are:

o The Department's 1992 Georgiana Slough Test Barrier Project,

o Support for the Delta-Mendota San Luis Water Authority's Georgiana Slough acoustic barrier tests in 1993 and 1994,

o Support for the Corps' current reconnaissance level investigation of the Deep Water Ship Channel as a supplemental migration route for anadromous fish, and

o The Department's proposed Hood Test Fish Screen Facility.

While this work has been underway there have been profound changes in the Bay-Delta planning framework. The two most important developments were:

o The initiation of the long-term solution finding process for the Bay-Delta, initially the responsibility of the Bay-Delta Oversight Council, now to be a joint State-Federal Process under the 1994 Framework Agreement;

o The interim Bay-Delta standards setting process involving the Environmental Protection Agency, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation, the State Water Resources Control Board, the State Department of Fish and Game, and the State Department of Water Resources under their various jurisdictional authorities. The

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December 15, 1995 agreement is expected to be formalized in Bay-Delta standards, currently under review in draft form.

Program Changes

As a result of the new information available and the developments in the Bay-Delta planning framework, there have been several major changes in the proposed preferred alternative.

o The preferred alternative has been downsized to provide interim, incremental benefits while the long-term State-Federal solution finding process moves forward. The most costly component of the original North Delta Program, new setback levees along the channels of the Mokelumne River and the North Mokelumne River, has been eliminated from the preferred alternative, but will still be considered in the planning process. This feature was eliminated because (a) the magnitude of construction activity required to implement it places it in the category of long-term Delta solution options, (b), major environmental impacts due to loss of farmland and wildlife habitat associated with new channels and levees, and (c) engineering uncertainty associated with new levee construction on unconsolidated peat foundations.

o Extensive efforts have been made to advance methods of reducing fisheries impacts associated with diversions from the Sacramento River. The INDP proposes to continue and to expand upon these efforts, by including testing and possible implementation of acoustic fish barriers, deflectors, use of the Sacramento Deep Water Ship Channel as an anadromous fish migration route, and including an alternative to implement a 2000 cfs screened diversion at Hood. The proposed 2000 cfs diversion at Hood could provide interim benefits to fisheries, water quality, and water reliability, while developing practical information required for the long-term State-Federal solution finding process. The information gained from such a diversion would be equally applicable to future through-Delta, dual transfer, or isolated conveyance solution options: For all these options a system for diverting water from the Sacramento River system which minimizes fisheries impacts needs to be developed.

o A definite site from which to borrow materials needed to improve levees and to mitigate for potential wildlife habitat impacts has been purchased.

o Efforts have been made to protect long-term planning flexibility by coordination with the USFWS during and after the establishment of the Stone Lakes National Wildlife Refuge. The refuge includes a portion of the alignments of proposed water transfer facilities originating at Hood, on the Sacramento River. A commitment to coordinate the State's water resources planning with refuge development was included in the 1992 Record of Decision for the SLNWR, and followed with a 1993 Memorandum of Understanding between the Department and USFWS.

Summary of Preferred Alternative Features

The preferred alternative for the Interim North Delta Program includes the following interrelated actions:

o Dredging of the North Mokelumne River, South Mokelumne River, Mokelumne River, Snodgrass Slough and the Delta Cross Channel to increase channel capacities. Maximum depth of dredging would be 20 feet and side slopes would be mild enough to assure levee stability.

o Levee improvement along these same channels, primarily by adding dredged materials to the landward slopes of the levees. Levees would generally not be raised, except to meet FEMA's existing Hazard Mitigation Plan requirements, which call for one foot of freeboard over the 100-year flood elevation.

o A 2000 cfs screened diversion of water from the Sacramento River at Hood to the Mokelumne River system, via South Stone Lake and Snodgrass Slough. This diversion would provide practical data for the long-term State-Federal Delta solution finding process, reduce reverse flow, and reduce unscreened flows passing through the Delta Cross Channel and Georgiana Slough.

Summary of Engineering Data, Preferred Alternative

(Data is being developed. Categories shown below)

o Cost:

o Volume of dredged Material:

o Volume of imported material:

o Miles of channel dredged:

o Miles of levees improved:

o Construction duration: Construction is expected to take about 24 months. However, this is highly dependent upon dredging restrictions promulgated under the Endangered Species Act and State Endangered Species Act.

o Methods of construction: Channel dredging would be by use of barge mounted clamshell dredge, to minimize costs, mobilization of potential toxics, impact areas, and drying times.

Work would proceed from the San Joaquin northward along the North Mokelumne to New Hope Landing, then begin again at the south end of the South Mokelumne River northward to New Hope Landing, and finally northward along Snodgrass Slough and Dead Horse Cut to the Delta Cross Channel. This sequence of construction would assure that flood stages are not raised downstream.

The 2000 cfs screened diversion near Hood would be constructed behind existing levees. Highway 160 would have to be temporarily relocated during construction of a new bridge across the intake channel, if a folded "V" vertical plate screen design is selected. Fill would be placed behind the existing levee to support intake channel, screen, and pump structures, and to assure that critical facilities were protected from flooding.

o Potential average annual SWP yield: Proposed new outflow standards and export restrictions may mask potential reductions in carriage water associated with the preferred alternative, possibly eliminating water supply gains.

o Potential average critical period SWP yield: See note above.

o Approximate payback period:

Summary of Environmental Consequences, Proposed Mitigation, and Enhancement, Preferred Alternative

o Flood Hydrology: 100-year flood stage reduction of about 2.5 feet at New Hope Landing, with decreasing effects upstream and downstream. Concerns about changes in velocities and downstream stages need to be analyzed to assure no negative impacts occur. Minor reduction in duration and stage of flooding in Cosumnes River Preserve area, may compensate for recent placement of new berms and levees for creation of wetlands within the preserve. Potential minor growth-inducing impact east of I-5.

o Hydrodynamics: With a 2000 cfs screened diversion from the Sacramento River at Hood into the Mokelumne River system, there would be both a reduction in unscreened diversions through the Delta Cross Channel and Georgiana Slough as well as a reduction in reverse flow in the western Delta.

For example, with a Sacramento River flow of 10,000 cfs, there would be an estimated 1400 cfs reduction in net unscreened flow through The Delta Cross Channel and Georgiana Slough as well as a 600 cfs reduction in reverse flow when the Cross Channel gates are open.

With increasing Sacramento River flow, the balance would shift. For example, with a Sacramento River flow of 20,000 cfs, there would be an estimated 1100 cfs reduction in unscreened diversion through the Delta Cross Channel and Georgiana Slough and a 900 cfs reduction in reverse flow.

o **Water Supply:** Water supply benefits will depend upon Delta standards and how the project is operated within the constraints of those standards. Under certain low flow conditions, the INDP improvements would reduce the amount of Delta outflow required to achieve a given level of west Delta water quality, thereby achieving a savings in net water supply. Alternatively, the project could be operated to achieve water quality improvements or fisheries resources improvements, without water supply gains. Assuming water supply benefits were to be optimized, the estimated incremental average annual yield would be ______ thousand acre-feet per year, estimated average annual critical period yield would be _______ TAF (Modeling of water supply effects is currently underway).

o **Water Quality:** A slight improvement in Delta water quality is anticipated in the north Delta area due to larger flows of high quality Sacramento River water entering the central Delta via the Delta Cross Channel when it is open and via a diversion facility at Hood. West Delta water quality improvements would be determined to a large extent by Delta standards and operational goals, as discussed under Water Supply. Full compliance with all standards is anticipated.

Potential impacts of construction activities on local water quality would be addressed by monitoring of water and sediments prior to, during, and after dredging operations to assure no mobilization of sediment toxics, dissolved oxygen sag, or turbidity impacts.

Runoff and erosion from construction areas, particularly the landward slopes of reinforced levees, would be managed until revegetation takes effect. Specific measures, including placement of straw, reseeding, and runoff detention, would be employed.

o **Fisheries and Aquatic Resources:** It is anticipated that both the reduction in unscreened diversions through the Delta Cross Channel and Georgiana Slough and the reduction in reverse flow would have a beneficial effect upon anadromous and resident fish populations.

Loss of some shallow water habitat in dredged channels is anticipated. Mark-recapture experiments have suggested that juvenile salmonid migration mortality is lower along the North Mokelumne than along the South Mokelumne; thus dredging of the South Mokelumne may meet with strong objections. Several mitigation and enhancement measures would be implemented:

- dredge berm construction where appropriate for riparian enhancement to benefit fish, by providing shade, cover, and enhanced food supply.

- Log booms, snags, and fabric webs to enhance fisheries habitat, cover and protection from wave wash. Also provides enhanced habitat for western pond turtle.

- channel island erosion protection addition of dredged material, and replanting. Channel islands provide additional diverse shoreline habitat, increasing value for fishery resources by providing additional shoreline with cover, shade, and enhanced food supply.

- creation of shallow water, seasonal and permanent wetlands habitats on Grizzly Slough property to benefit resident fish and a wide range of aquatic and wetland species.

- Possibly creating replacement shallow water habitat by creating short levee setbacks to create embayments like Westgate Landing, but where foundation conditions and hydraulics are appropriate. Mitigate for loss of shallow water habitat lost through dredging.

- acoustics, deflectors, and other measures to guide migrating salmonids at Steamboat, Sutter, DXC, Georgiana Slough, and at the northern junction of the North Mokelumne River and South Mokelumne River.

- Hood test fish facility, with up to 200 cfs diversion into Snodgrass Slough. This measure could lead to signifcant reductions in fish losses associated with diversions from the Sacramento River. Fish passage facilities for straying upstream migrants would also be tested and developed.

- Proposed local sponsor for Corps SDWSC fish passage measures if a federal interest is identified. This could lead to incremental reduction in salmonid migration losses through reduced mortality of upstream migrating adults and downstream migrating smolts.

- Article VII mitigation measures if needed

- Possible use of Mc Cormack Williamson Tract for shallow water, permanent wetland, seasonal wetland, to enhance spawning, rearing habitat for delta smelt and other resident species.

- Timing of dredging operations to minimize impacts on Delta smelt, winter run, and other target species

o **Wildlife Habitat Resources:** Existing wildlife habitat on the landward slopes of levees would be temporarily destroyed during and after placement of dredged materials. Construction activities could affect sensitive species, including the state-threatened Swainson's hawk. Many of the measures for mitigation and enhancement of fisheries and aquatic habitat would also benefit wildlife habitat, and are listed here for completeness.

- Erosion control, reseeding, and implementation of Best Management Practices on landward slopes of existing levees.

- dredge berm construction where appropriate for riparian enhancement to benefit wildlife, by providing cover and enhanced food supply.

- channel island erosion protection addition of dredged material, and replanting. Channel islands provide additional diverse shoreline habitat and conditions especially favorable for sensitive native species. They increase value for wildlife resources by providing additional shoreline with cover and enhanced food supply.

- creation of seasonal and permanent wetlands habitats and mixed oak woodlands, as well as continued farming with enhanced wildlife benefits on Grizzly Slough property to benefit a diverse range of wildlife species.

- Possible use of Mc Cormack Williamson Tract for permanent wetland, seasonal wetland, riparian scrub shrub and riparian forest to benefit a diverse range of wildlife species.

- Coordination of construction with nesting of sensitive species, particularly the threatened Swainson's Hawk o **Utilities and Highways:** Minimal, temporary disruptions of traffic along Highway 160 and Thornton-Walnut Grove Road is expected. Highway 160 traffic would be rerouted around Delta Cross Channel enlargement activities on a temporary detour. Prior notification of landowners and users of highways through media, signs, and direct mailings would allow those who might be affected to plan alternate travel times and routes, or to plan ahead for potential delays.

Utilities will be contacted prior to construction and relocation activities funded by the project, but performed by the utilities. These may include antennas, power lines, communication lines, and pipelines.

o **Agricultural Resources:** A portion of the Grizzly Slough Mitigation/Borrow site would be converted from agricultural use to permanent wildlife habitat, while about 150 acres would continue to be farmed. No other significant impacts are anticipated. No mitigation is planned for this loss of agricultural land.

o **Soils and Sediments:** Dredging of channels and borrowing soils from the Grizzly Slough Mitigation/Borrow site will take place. Mitigation focuses on temporary or permanent alteration of habitat, and is discussed elsewhere in this section. No mitigation required under this category.

o **Socioeconomics:** No anticipated impacts. Construction will provide temporary local employment. About $80 million will be injected into local economy during the 2 year construction period. The construction zone is within commuting distance of Sacramento, Stockton, Galt, Lodi, Davis, and Delta communities, thus no additional housing will be required.

o **Land Use and Aesthetics:** There will be a temporary disturbance of soil and vegetation during the construction period, as well as dust, noise, and exhaust from operating equipment. These are typical in an agricultural area. Normal construction practices will be used to suppress dust, minimize noise and aesthetic impacts. Disturbed areas will be revegetated within one growing season. There will be a net aesthetic enhancement of river channels as a result of the project, due to permanent increase in Shaded Riverine Aquatic Habitat.

o **Topography, Geology, and Seismic Risk:** There will be a temporary increase in consolidation rate of levee foundations due to the placement of material on the landward sides of the levees, particularly south of the latitude of Hog Slough, where significant depths of organic soils are found. There will be a minor, long-term reduction in risk of seismic failure, due to the placement of this material. However, the potential for structural failures in the event of a major earthquake remains high. No mitigation required in this category.

o **Energy:** There will be an increase in statewide energy consumption in the event that water exports of water from the Delta are increased.

o **Cultural Resources:** No significant impacts are anticipated. Construction will follow normal practices, in which a qualified archaelogist would be available during the construction, and would be notified if any materials of historic value are discovered during construction. Known and newly discovered sites would be protected as directed by the archaeologist on site.

o **Navigation:** Temporary disruption of navigation may be anticipated during channel dredging operations.

o **Recreation and Public Access:** Minimize impacts on recreational boating by notifying boating public through newspapers, contacts with marinas, boating publications, etc, floating signs in channels, closing only North Mokelumne or South Mokelumne, but not both at same time, avoiding dredging operations on holidays and weekends if possible.

Mitigation and enhancing recreational opportunities through measures recommended in recreation planning report. Also in this category could be a visitor/information center where public could view Department's fish protective research and measures (i.e. in Hood).

o **Climate and Air Quality:** No significant impacts anticipated.

Range of Alternatives Considered in EIR/EIS

The alternative analysis begins with a broad array of possible actions which could help meet one or both of the main project purposes. These alternatives are being screened in three stages of increasingly rigorous analysis, leading to the selection of the preferred alternative. Alternatives included in Stage 1 and 2 are listed below. The alternative analysis complies with guidelines under CEQA, NEPA, and the Clean Water Act, Section 404(b)(1).

Stage 1 and 2 Analysis

- No Action, Existing Conditions
- No Action, Future Conditions
- Dry Creek designated 100-year floodway
- Other non-structural flood control measures
- Levees and channel improvements
- Thornton ring levees
- Raise or Reoperate Camanche Dam

Raise or Reoperate Pardee Dam
Construct Middle Bar Dam
Construct dam at Coarson Creek School site
Construct dam at Latrobe Dam site
Construct dam at Cape Cod dam site
Dredge South Mokelumne River
Dredge South Mokelumne and enlarge DXC gates
Dredge South and North Mokelumne rivers
Dredge South and North Mokelumne rivers, and enlarge DXC gates
Dredge South and North Mokelumne rivers, and construct 2000 cfs diversion at Hood
Levee setbacks South Mokelumne River, dredge North Mokelumne River
Levee setbacks South Mokelumne River, dredge North Mokelumne River, enlarge DXC gates
Levee setbacks North Mokelumne River, dredge South Mokelumne River
Levee setbacks North Mokelumne River, dredge South Mokelumne River, enlarge DXC gates
Create an island floodway, enlarge DXC gates
Conserve, reclaim, desalt, accept increased risk, but no additional export from Delta
Isolated Transfer System
Dual Transfer System
Modified Folsom South Canal
Mathena Landing Canal
West/Central Delta Canal
Montezuma Hills Reservoir and Canal
New Hope Cross Channel
Isleton Cross Channel and Enlarged Clifton Court Forebay
Waterway Control Plan
North Stub Canal
South Stub Canal
Mathena Landing Cross Channel and South Stub Canal
Chipps Island Barrier
Dillon Point Barrier
Point San Pablo Barrier
Submerged Sill, Carquinez Strait
Delta Island Storage

Required Program Documentation

The following reports are being prepared, with the target completion date of August 1995:

- o Draft EIR/EIS
- o Draft 404(b)(1) Alternatives Analysis Report
- o Draft Feasibility Report
- o Draft Mitigation Plan Report

Major Work Tasks Remaining

o Draft EIR/EIS:

-Complete HEP Study
-Complete Biological Assessment
-Update modeling of floods, Delta low flow conditions, and water supply impacts
-Update environmental impacts analyses
-Rewrite report text

o Draft 404(b)(1) Alternatives Analysis Report

-Update background text
-Complete three stage alternative analysis

o Draft Feasibility Report

-Compile data on seepage monitoring wells, locations and data
-Compile scour, Sedimentation Monitoring sites and data
-Compile soils data
-Compile geologic data, from recent and old borings
-Catalog and map utilities:
-Complete advance design
-Describe project construction methods
-Describe project construction sequence
-Quantities
-Cost Estimates
-Write draft report

o Draft Mitigation Plan Report

-Describe preferred alternative
-Describe mitigation management process and resources
-Develop and describe mitigation measures for each resource
-Write draft report

PROJECT DESCRIPTION
FOR
INTERIM NORTH DELTA PROGRAM

INTRODUCTION

The purposes of the Interim North Delta Program (INDP) are to improve State Water Project (SWP) reliability through reduction in reverse flow and to improve flood protection in the lower Mokelumne River system.

Potential additional benefits of implementing the program include improved water quality, reduced fishery impacts, greater SWP operational flexibility, enhanced recreational opportunities, and improved wildlife habitat.

PREVIOUS WORK

The Draft EIR/EIS for the North Delta Program was released in November 1990. Since then, DWR has conducted additional studies, and revised project alternatives to reflect current institutional, biological, and engineering constraints. The program was originally initiated in response to reverse flows induced by SWP and Central Valley Project export operations in the south Delta and serious, repeated flooding in the north Delta area, such as the February 1986 flood and the May 1972 flooding of Brannan-Andrus Island. Historical records suggest that channel dredging has been periodically undertaken for levee construction and channel enlargement in north Delta channels since the early 1900s.

PROJECT LOCATION

The proposed INDP project alternatives are located in the northeastern portion of the Sacramento-San Joaquin Delta, generally within an area which lies south of Freeport, west of Interstate-5, north of the San Joaquin River, and east of Georgiana Slough (Figure 1).

Channel Names

The Cosumnes River, Dry Creek, and the Mokelumne River converge east of I-5. During high flows, the combined flows of these streams split to pass westward around both the north and south sides of McCormack-Williamson Tract. On the north side, Lost Slough conveys flows to Snodgrass Slough. On the south side, the Mokelumne River flows to the northeastern end of Staten Island, where it splits into two channels, the North Mokelumne River and the South Mokelumne River. The North Mokelumne River flows on the northern and western sides of Staten Island, and the South Mokelumne River flows on its eastern and southern sides. The two channels meet again at the southwestern tip of Staten Island, from where the channel is again called the Mokelumne River until it meets the San Joaquin River.

Snodgrass Slough and Dead Horse Cut rejoin the Mokelumne River system at the northern end of Staten Island. They convey flows southward from the Morrison Creek system, the Delta Cross Channel, and as noted earlier, also convey a portion of the flow from the Mokelumne River, Cosumnes River, and Dry Creek.

PROGRAM ALTERNATIVES

Alternatives considered in detail in the EIR/EIS are as follows:

1) No Action;

2) South Mokelumne Dredging;

3) South Mokelumne Dredging, North Mokelumne Dredging;

4) South Mokelumne Dredging, North Mokelumne Dredging, and Delta Cross Channel Enlargement;

5) South Mokelumne Dredging, North Mokelumne Dredging, and Screened Diversion at Hood;

6) South Mokelumne Dredging, North Mokelumne Dredging, Levee Setbacks, and Delta Cross Channel Enlargement; and

7) Non-structural alternative (described elsewhere);

Each of these alternatives consists of one or more components. To avoid repetitive descriptions of the components which appear in several alternatives, each of the components will be described in the following sections, first in fairly general terms, followed by more detailed and technical information on each component.

Based upon currently available information, Alternative 5 has tentatively been identified as the preferred alternative.

Summary of Alternative Components

All the alternatives which involve construction of some sort in the project area consist of various combinations of the following components:
- o South Mokelumne Dredging
- o North Mokelumne Dredging
- o Levee Setbacks
- o Delta Cross Channel Enlargement
- o Screened Diversion at Hood

South Mokelumne Dredging

Channel dredging and levee improvements would include levee reinforcement, erosion protection, vegetated water-side berms, and levee vegetation best management practices along the following channel segments (Figure 2):

o Mokelumne River from the San Joaquin River to the junction of the South Mokelumne River and North Mokelumne River.

o South Mokelumne River.

o All the channels surrounding Dead Horse Island, including Snodgrass Slough, Dead Horse Cut, and a portion of the North Mokelumne River.

o Mokelumne River from New Hope Landing upstream to the upstream end of McCormack-Williamson Tract.

North Mokelumne Dredging

Channel dredging and levee improvements would include levee reinforcement, erosion protection, vegetated water-side berms, and levee vegetation best management practices along the North Mokelumne River from its confluence with the South Mokelumne River at the southwestern tip of Staten Island to its confluence with Snodgrass Slough at the northwestern tip (Figure 3).

Levee Setbacks

This option would include excavating a new parallel channel and constructing new setback levees. Construction of new setback levees would be in lieu of improvements to the levees they would replace when combined with dredging options. Setback levees would be constructed mostly on unconsolidated peat soils along the following channel segments (Figures 4, 5):

o Mokelumne River from the San Joaquin River to the junction of the South Mokelumne and North Mokelumne.

o North Mokelumne River from its confluence with the South Mokelumne River at the southwestern tip of Staten Island to its confluence with the South Mokelumne River at the northeastern tip of Staten Island.

o Mokelumne River from New Hope Landing upstream to the upstream end of McCormack-Williamson Tract.

o Two new bridges would be constructed to cross the new channel, one for State Highway 12 across the lower Mokelumne River, and one for Thornton-Walnut Grove Road across the North Mokelumne River.

Delta Cross Channel Enlargement

Delta Cross Channel enlargement would consist of a new intake channel and a new three-gate intake structure north of the existing Delta Cross Channel (Figures 6, 7).

The Delta Cross Channel Enlargement would include the following: A new intake channel, a fish deflector wall, a new bridge, a radial gate control structure, control building and a propane tank buildings, levee embankments, and downstream dredging and enlargement of the existing Delta Cross Channel. Dredging and levee improvements would include levee reinforcement, erosion protection, vegetated water-side berms, and levee vegetation best management practices along Snodgrass Slough from the Delta Cross Channel to Dead Horse Cut.

Screened Diversion at Hood

The new screened diversion facility near Hood would have a capacity of approximately 2,000 cfs. It would divert water from the Sacramento River at Hood into the Mokelumne River system via the Stones Lakes drainage canal (Figure 8, 9). The facility would include a trash rack on the riverbank, a rectangular concrete intake channel, stoplogs to isolate the intake channel from the Sacramento River, vertical folded "V" screens, a sediment trap, a fish bypass and return system, pumps, conveyance pipeline, and an energy dissipator and outfall structure. Facilities for guiding, capturing, and transporting upstream-migrating adults would also be provided. This could include a guide screen, a floating screw trap and live box, and a fish tank truck or live box truck for transporting the adults back to the Sacramento River. A bridge would be constructed for conveying Highway 160 over the intake channel. Access roads, parking facilities, an office, and maintenance building would also be required.

Diverse biological resources habitat features could also be created in the vicinity of the screen facilities. These features would complement habitat development associated with the Stone Lakes National Wildlife Refuge. In addition, the proposed diversion of Sacramento River water could improve water quality and quantity for the refuge.

MORE DETAILED DISCUSSION OF ALTERNATIVE COMPONENTS AND CONSTRUCTION METHODS

Channel Dredging

Barge-mounted clamshell dredging is proposed as the preferred method for excavating material from channels and obtaining fill material for levee improvements.

Clamshell dredging provides several advantages important to the north Delta area. Material excavated by clamshell has a much lower water content than that excavated by suction dredge. In addition, the material is typically semi-solid when excavated. Thus, the material can be placed on the land-side levee slope as soon as it is excavated from the channel. Once on the levee slope, it can dry quickly, then be shaped and compacted.

Suction dredging requires that a cascade of large ponds be established to contain and clarify the excess water. Drying is slow, and the material cannot be placed on levee slopes for several months. The excess water must be pumped back into the river channel due to the fact that most lands in the area to be dredged are near to or below sea level. Finally, large amounts of land would be taken out of production, with both economic and wildlife impacts. For these reasons it is likely that suction dredging would be far more expensive and difficult than clamshell dredging.

The proposed dredging would not extend below a depth of about 20 feet below mean sea level. Dredging would generally follow the existing side slopes, no steeper than two horizontal to one vertical, while maintaining the existing riprap and vegetation as much as possible. The need to maintain levee stability may require a reduction of slopes in some areas.

Channel islands would not be disturbed in order to preserve their integrity as wildlife habitat areas. Channel dredging would be coordinated to assure that there would not be damage to marinas and/or hydraulic structures (Figure 10 and Table 1).

Increased turbidity in the channels would occur during the dredging and levee improvement periods only. DWR would periodically monitor water quality throughout the dredging operations period in accordance with a monitoring plan approved by the Regional Water Quality Control Board.

Levee Reinforcement

With a combination of clamshell dredger and a barge, the dredged material from the channel would be either directly deposited by clamshell on the appropriate disposal locations or loaded onto barges and transported there by barge. The dredged material would be used to improve the land-side slope of existing levees, construct land-side slope stabilizing berms, repair shoreline erosion sites, and create vegetated water-side berms where appropriate. In general, the area of material placement would include the levee crown and a band extending about 150 feet landward from the levee crown shoulder (Figure 11).

With a combination of clamshell and barge in the water and front end loaders, bulldozers, graders, vibrating compaction equipment, and other earth moving equipmenton the ground, the dredged material from the channel would be placed on the land-side levee slope and in land-side berm to improve levee stability. A filter/drain system consisting of a drain fabric, a drain rock and lateral drainage pipes, which are connected to a perforated pipe, would be inserted in the land-side levee if required.

After placement, the dredged material deposited on the land-side levee slope would require grading to achieve correct slopes, which would vary from 2:1 to 5:1. The dredged material placed in the land-side berm would require contouring to create land-side stabilizing berm. The thickness of this berm is estimated to be three feet. Some construction material, such as soil and drain rock, would be imported with dump trucks.

During the construction of land-side levee improvements, DWR would require the contractor to comply with local, state, and federal noise and air quality ordinances and to minimize adverse effects. The contract specifications would also require the contractor to apply appropriate dust control measures on detours and operating roads.

Earthmoving equipment such as loaders, bulldozers, graders and compacting equipment would be transported by trucks to the job sites to help place, shape, and compact the dredged material. Trucks would deliver the construction material to the construction sites at designated lay down areas. At the end of every work day, construction equipment would be parked at the construction site. Other equipment and material would be laid down on, or stored in, one of the selected staging areas.

Erosion Protection Methods

Existing riparian vegetation would be protected and enhanced wherever possible. However, experience has shown that vegetation alone is not enough to protect fragile Delta levees from erosion due to wave wash, tidal currents, and flood flows. Isolated areas of active erosion and slippage need to be repaired and protected. In addition, levees can be made more stable and erosion resistant, while at the same time providing additional substrate for riparian or shallow water habitat, through the use of vegetated water-side berms.

Rip-rapping has traditionally been used to protect levee slopes from erosive currents and wave wash in the Delta. It consists of placing broken rock in the size range of one to 20 pounds on the levee slopes by use of clamshell or dragline. It has proven to be the most economical and flexible technique. However, the rip-rap is vulnerable to loss of underlying levee material when waves break against the shoreline, pumping jets of water between the rocks. The eventual loss of fine material through this pumping action undermines the rock and results in slippage. Once the underlying levee is exposed, erosion accelerates.

When a layer of construction fabric is placed underneath the rock layer, it effectively retains the fine levee material and thus improves the effectiveness of the rip-rap layer. It is anticipated that for most areas where additional erosion protection is required, this system would be used (Figure 12).

In areas of exceptional erosion potential, other, more expensive and effective protective systems may be employed on a case-by-case basis. These include interlocking concrete blocks, synthetic mats to help hold rooted plants, gabions, fabric bags, and other systems.

Vegetated Waterside Berms

Vegetated water-side berms can improve levee stability, increase erosion protection and enhance riparian or shallow water habitats. Various construction techniques have been tried by the U.S. Army Corps of Engineers along project levees and by Reclamation Districts in the Delta.

A recent three-year project along the levees of Staten Island has included over 4,000 feet of berm construction. The berms were constructed by placing a rock prism about fifteen feet from the existing shoreline, placing a layer of construction fabric on the bottom and over the rip-rap, backfilling between the rock and the levee with dredged material, and wrapping the construction fabric back over the dredged material (Figure 26).

A similar approach is proposed for berm construction associated with the INDP. A barge-mounted dragline or clamshell would be used to place the rip-rap and dredged material to construct the berms. In general, the rock dike would be raised to a height of about one foot above the mean high tide, so that the berm would be kept moist and the outer zone of the new berm would occasionally be subjected to inundation. The berm elevation could be varied to create a range of micro-habitats, including protected shallow water habitat, tidal wetland, riparian scrub shrub, and riparian forest.

Following construction of the new water-side berm, cuttings would be inserted into the surface of the new berm to accelerate growth of desirable riparian or shallow water vegetation species. Experience with this construction approach has shown that the berms re-vegetate rapidly. There could be a temporary increase in surface erosion due to channel flow, rain, and wind until a new vegetation cover could be established. This erosion could be mitigated by planting and establishing at the appropriate times of the year.

Local water quality problems, such as increased turbidity, would occur for a short time in the channel due to dropping and positioning of rock along shorelines. This impact would be extended through the dredging and levee improvement periods only.

Levee Vegetation Best Management Practices

Vegetation management along levees in the project area is an important tool to be used in conjunction with other techniques to reduce wave damage to levees. Management of vegetation on levee slopes is important for levee inspection, erosion protection, wildlife habitat value, and aesthetics. The preferred vegetation consists of grasses and herbaceous cover, which can be rapidly established by means of hydro-seeding. Maintenance methods to retain the preferred cover can include periodic removal of new woody vegetation on both water-side and land-side slopes, selective grazing, mowing, use of herbicides, and periodic re-seeding.

Levee Setbacks

Setback levees are levees constructed inland from an existing levee, running parallel to the existing levee but set back on the land-side an appropriate distance. A new channel would be excavated between the new and existing levees (Figures 4, 5, 13-17). The setback levees would be constructed on generally weak, unconsolidated peat, sand, and clay foundations.

The old levees would be left in place as channel islands to provide channel separation, high quality riparian habitat, and destination points for recreational activities. Waterside levee slopes would be protected with riprap, normally placed between the low water and high water elevations to guard against erosion (Figure 12).

Setback levees would alternate from one side of the channel to the other depending on existing vegetation, soil conditions, public utility facilities, distance to borrow sites and location of structures, such as homes, silos, and marinas.

In addition to the new setback levee, the dredged material from the existing channel bottom would be transported by a combination of clamshell and barge, and deposited on the land-side of existing levees or on the new levees, or to create vegetated water-side berms.

The foundation materials on which the new levees would be constructed are composed of unconsolidated peat, clay, silt, and sand soils with depths of peat soils varying from zero feet in the northern limit of the proposed levee setbacks to approximately 20 feet in the southern portion of both Staten and Tyler Islands and on Bouldin Island.

The total length of the setback levees and the new parallel channels would be 16.5 miles. This component would require an estimated 7.0 million cubic yards of borrow materials of which 5.5 million cubic yards would be imported from outside the project area and the remaining 1.5 million cubic yards would be borrowed from channel excavation. Imported materials would be hauled to the project area by trucks.

For the new parallel channels and setback levees, it was estimated that 1,041 acres of land would be acquired from McCormack-Williamson Tract, Dead Horse Island, Tyler Island, Staten Island, and Bouldin Island. The 1,041 acres would consist of the lands between the land-side toe of the proposed setback levees and the existing channels.

The cross-sectional area of the new channel, plus the existing North Mokelumne River, would be about 8,000 square feet. The maximum depth of excavation would be limited to 20 feet below mean sea level for both the existing and the newly constructed channels, with water side slopes no steeper than two horizontal to one vertical. The side slopes of the setback levee would vary from 3:1 to 5:1 on the land-side, depending on the depth of underlying peat in the foundation.

Setback levees would be constructed over generally poor foundations of unconsolidated materials. In the southern portion of the project area layers of peat, poorly consolidated clays, silts, and sands create particularly poor foundation conditions. In order to induce controlled foundation consolidation, the new levees would need to be constructed in a series of lifts, spread over three to five years. It is anticipated that fairly rapid consolidation would continue for a decade after initial construction, requiring periodic

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repair and addition of levee embankment material to maintain proper levee elevations.

The new channel area between the old levee and the new setback levee would be filled with water using siphons, with careful monitoring during the filling process. The existing levees would be breached only after monitoring of foundation, embankment, and seepage conditions indicates that the setback levees are stable and secure.

There is a great deal of uncertainty regarding the feasibility of constructing large setback levees on unconsolidated peat, clay, silt, and sand foundation conditions. A multi-year setback levee test program would be required to verify construction methods prior to implementing this alternative.

A new two-lane bridge would be required on Thornton-Walnut Grove Road to span the enlarged channel. The west end of the new bridge would be built next to the east end of the existing bridge, which is located along Walnut Grove Road, at Staten Island, over the North Mokelumne River, 280 feet downstream of its confluence with Snodgrass Slough. The new bridge is estimated to be 40 feet wide by 500 feet long (Figure 18). The main part of the new bridge would be similar to the existing one.

The State Highway 12 bridge over the Mokelumne River would also be extended to span the enlarged channel. The new bridge is estimated to be 50 feet wide by 500 feet long (Figure 19).

For the construction of the new bridges, after consultation with DWR project manager, the contractor would select appropriate sites for staging areas. An estimated 9(?) acres of land would be impacted for the bridge extension on State Highway 12 on the lower portion of the Mokelumne River (Figure 19).

The construction material and equipment for the new bridges would be transported to the construction sites by trucks. At the end of every work day, non-portable construction equipment would be parked at the construction site. Other equipment and material would be laid down, on or stored in, one of the selected staging areas.

During construction of the new bridges, DWR would require the contractor to comply with local, state, and federal noise ordinances and to minimize fugitive dust by watering. The contract specifications would also require the contractor to apply appropriate dust control measures on detours and operating roads. Road safety regulations would also be obeyed.

Local water quality problems, such as increased turbidity, may occur during foundation preparation.

Delta Cross Channel Enlargement

The new intake channel would be constructed approximately 300 feet north of the existing channel (Figure 6, 7, 21-23 and Table 2). The cross-section of the new intake channel would be trapezoidal with side slopes of 2:1, horizontal to vertical, with an approximate base width of 195 feet. Invert elevation of the new intake channel would be approximately 15 feet below sea level. This new intake channel would link the new three-gate structure with the Sacramento River and the enlarged Delta Cross Channel.

A fish deflector wall would be constructed to divert fish away from the Delta Cross Channel at the mouth of the new intake channel. The fish deflector wall would be constructed of 1/2" thick steel plate and would be approximately 200 feet long and 10 feet high. The fish deflector wall would be attached to bracing beams which would be mounted on a series of vertical and sloped (1:4) battered driven piles spaced approximately 20 feet apart. The lower portion of the fish deflector wall would be bent away from the piles (toward the center of the Sacramento River channel) at 1:1 slope.

A new reinforced concrete box girder bridge would be provided for County Road E-13 over the proposed new intake channel. The bridge would be approximately 500 feet long and 40 feet wide. It would have four spans supported on three piers and two abutments and would accommodate two lanes of traffic with six-foot-wide shoulders.

The radial gate control structure would be 206 feet wide, 75 feet long, and 36 feet high and would be located approximately 250 feet downstream from the mouth of the intake channel. This structure would house the three radial gates, each 60 feet wide by 30 feet high.

The levee embankments for the new channel would be constructed with imported material to a crown elevation of 21 feet NGVD and would have 16-foot-wide graveled roads. Side slopes of the levees would be 2:1, horizontal to vertical. The water-side levee side slopes would be protected using 24 inches of riprap.

The existing Delta Cross Channel would be enlarged downstream from its confluence with the new channel to accommodate the increased flow provided by the additional three radial gates. Approximately 900 lineal feet of the existing downstream north-side levee of the existing channel would be relocated approximately 95 feet further north to become a part of the new Cross Channel levee system.

Located next to and south of the gate control structure, a control building would be used to house the control system for the three radial gates. Power used to operate the control system would be supplied through buried power cables. A propane tank building would house the standby propane fueled power system.

An existing transmission tower would need to be relocated, because the new channel would affect some of the tower stay cables.

The construction period for the Delta Cross Channel Improvement is estimated to be 30 months, with a construction crew of about 75 people. The cost of the project is estimated to be 28 million dollars.

Screened Diversion at Hood

This component would be constructed in such a way as to assure that the integrity of the Sacramento River Flood Control Project would remain intact. This would be accomplished by surrounding the intake channel with embankments reaching the same crown elevation as the existing Project levee (about 27 feet MSL). As noted earlier, the intake and screen structure includes a trash rack at the river bank, a rectangular, concrete-lined intake channel, screens, a fish bypass system, and an afterbay with pumps to control flow rates through the structure (Figures 8, 9, 24, 25).

The intake channel would be about 150 feet wide and about 350 feet long, from riverbank to pump structure. The intake channel would be separated into three 49-foot-wide, parallel channels by concrete walls about 15 feet high. The screens would be set back about 250 feet from the river bank. From the pump structure the water would be conveyed by a series of parallel pipes eastward to the Stone Lakes Basin. The pipes would pass through the Southern Pacific Railroad embankment, which provides flood protection to the Hood area.

A new bridge would be constructed for Highway 160 about 100 feet landward from the existing levee road. The bridge would cross over the intake channel at approximately current grade.

The facility would be constructed without breaching the Sacramento River levee until the new embankment is completed. Construction would be completed in three stages. First, the new embankment material and the portion of the intake and screen system east of the existing levee would be constructed. Second, the new Highway 160 bridge would be constructed. Lastly, construction of the trashrack and the first segment of the intake channel would be completed, including excavating the existing project levee to accommodate the intake channel. This would require placement of sheetpiles in the Sacramento River around the intake to provide a dry construction environment. This would be the last major phase of construction.

The screened Sacramento River flow would be released into the Stone Lakes drainage, just south of Hood Franklin Road. The flow would be conveyed through an existing borrow channel west of the Southern Pacific Railroad embankment. However, the

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channel bottom would need to be dredged to a depth of about -10 feet MSL to accommodate the additional flow. In addition, two multi-culvert bridges across this channel would be replaced by one or more clear span bridges to provide access for private landowners in the South Stone Lakes area. The screened water would flow into South Stone Lake, through the Lambert Road hydraulic structure, and southward into Snodgrass Slough. The Lambert Road structure may need to be modified to accommodate the increased flow.

This diversion would have two inter-related effects. First, it would reduce the net flow through the Delta Cross Channel and Georgiana Slough by simultaneously reducing the stage in the Sacramento River and increasing it in Snodgrass Slough. The effect would be a partial substitution of screened flow through the diversion at Hood for unscreened flow through the Delta Cross Channel and Georgiana Slough.

The second effect would be a net reduction in reverse flow in the lower San Joaquin River and adjoining channels. With the Delta Cross Channel open and Sacramento River flow low, the Hood diversion primarily acts to reduce Delta Cross Channel flow. When the Delta Cross Channel is closed, the Hood diversion primarily acts to reduce reverse flow, because it has a relatively smaller effect on Georgiana Slough flows.

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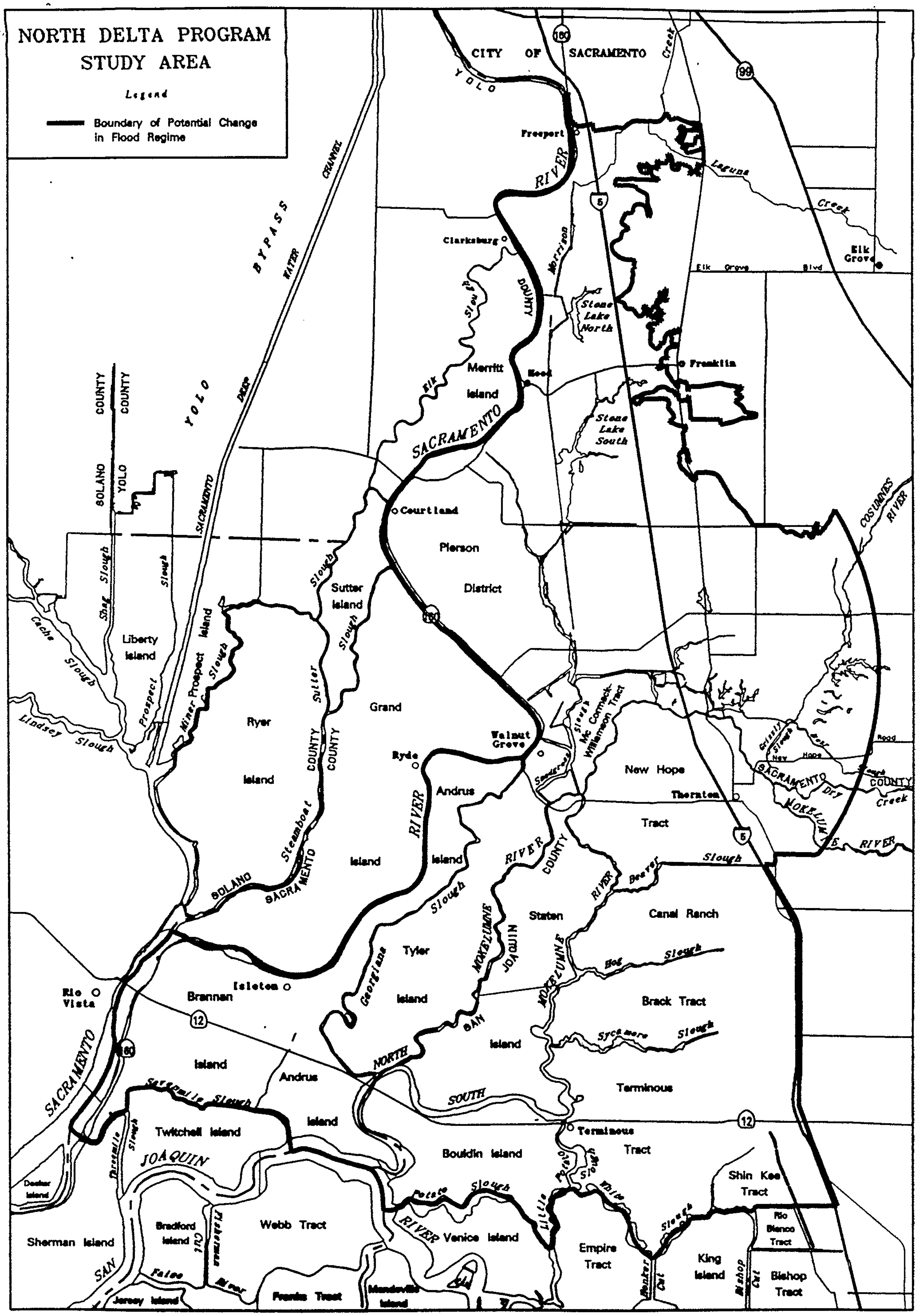

Figure 1. North Delta program Study Area

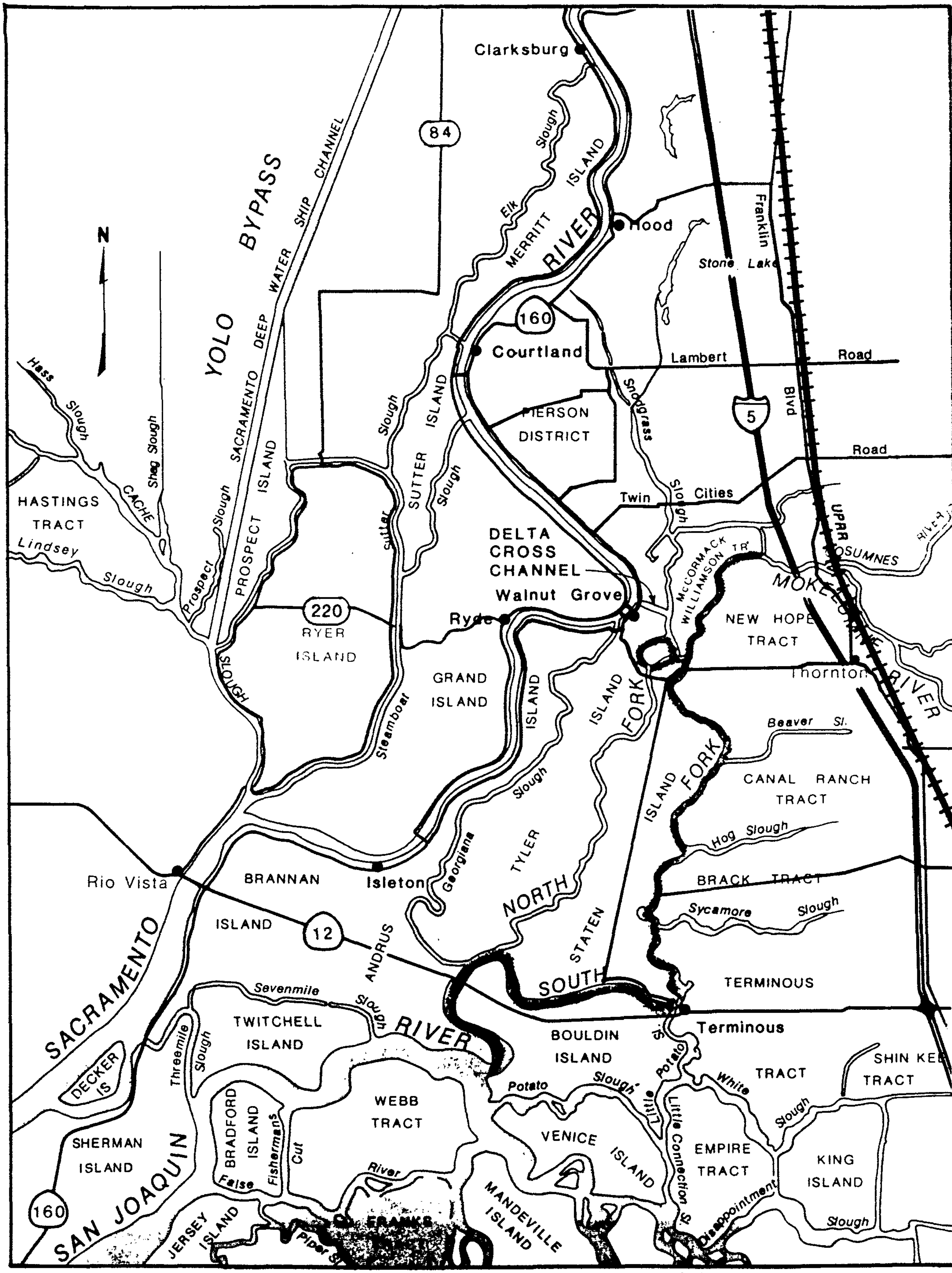

Figure 2. South Mokelumne Dredging

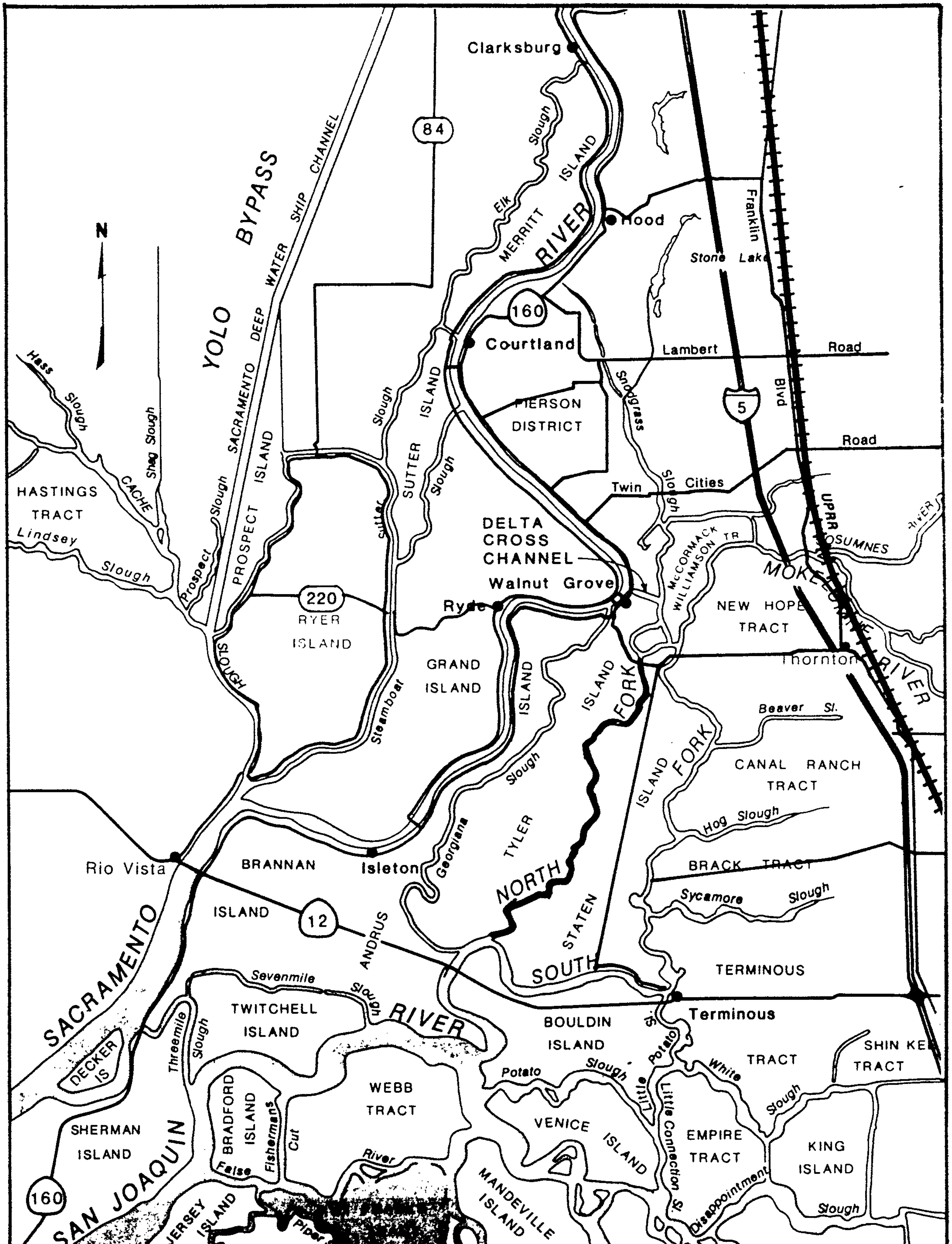

Figure 3. North Mokelumne Dredging

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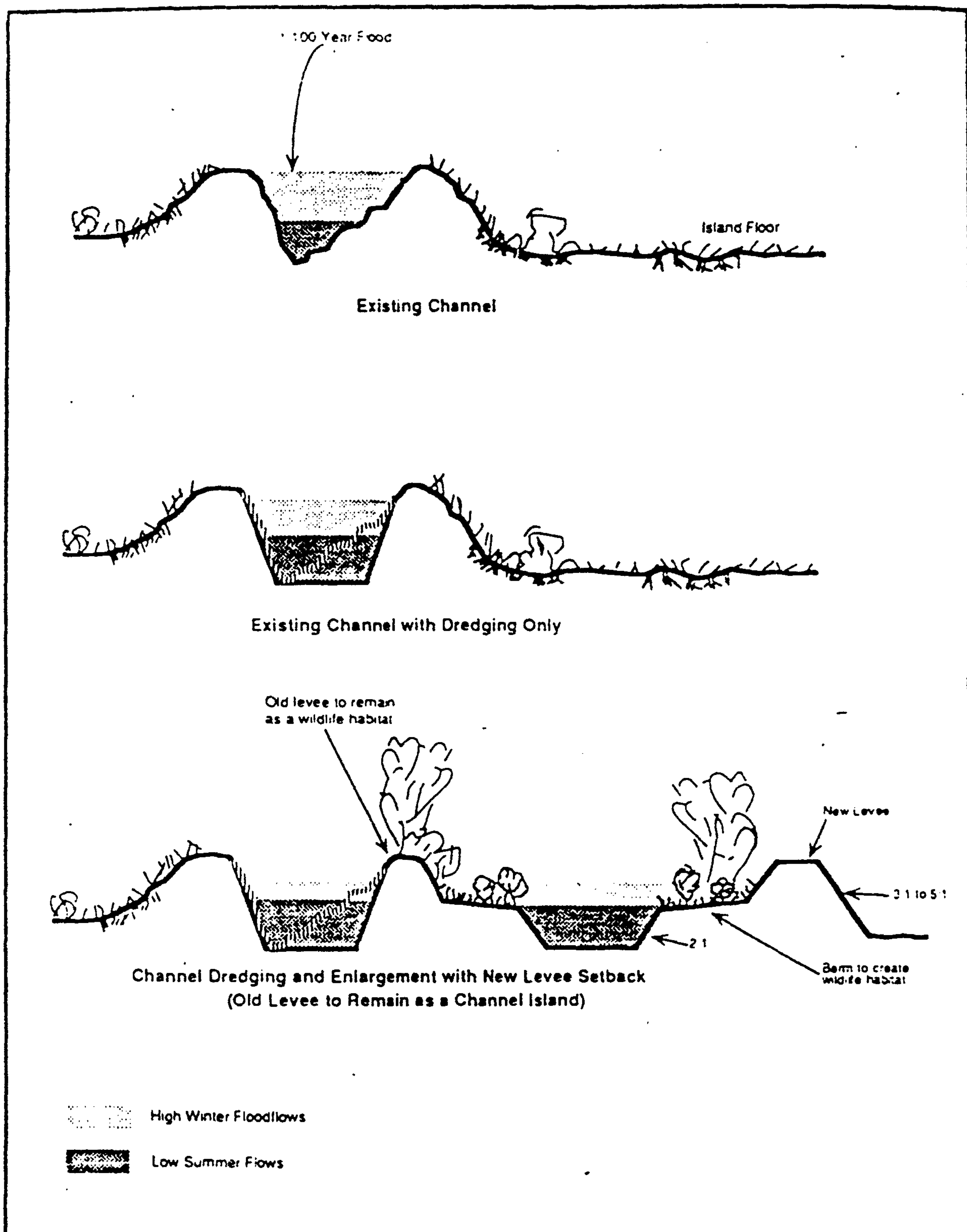

Figure 4. Levee Setbacks, Typical Cross Section

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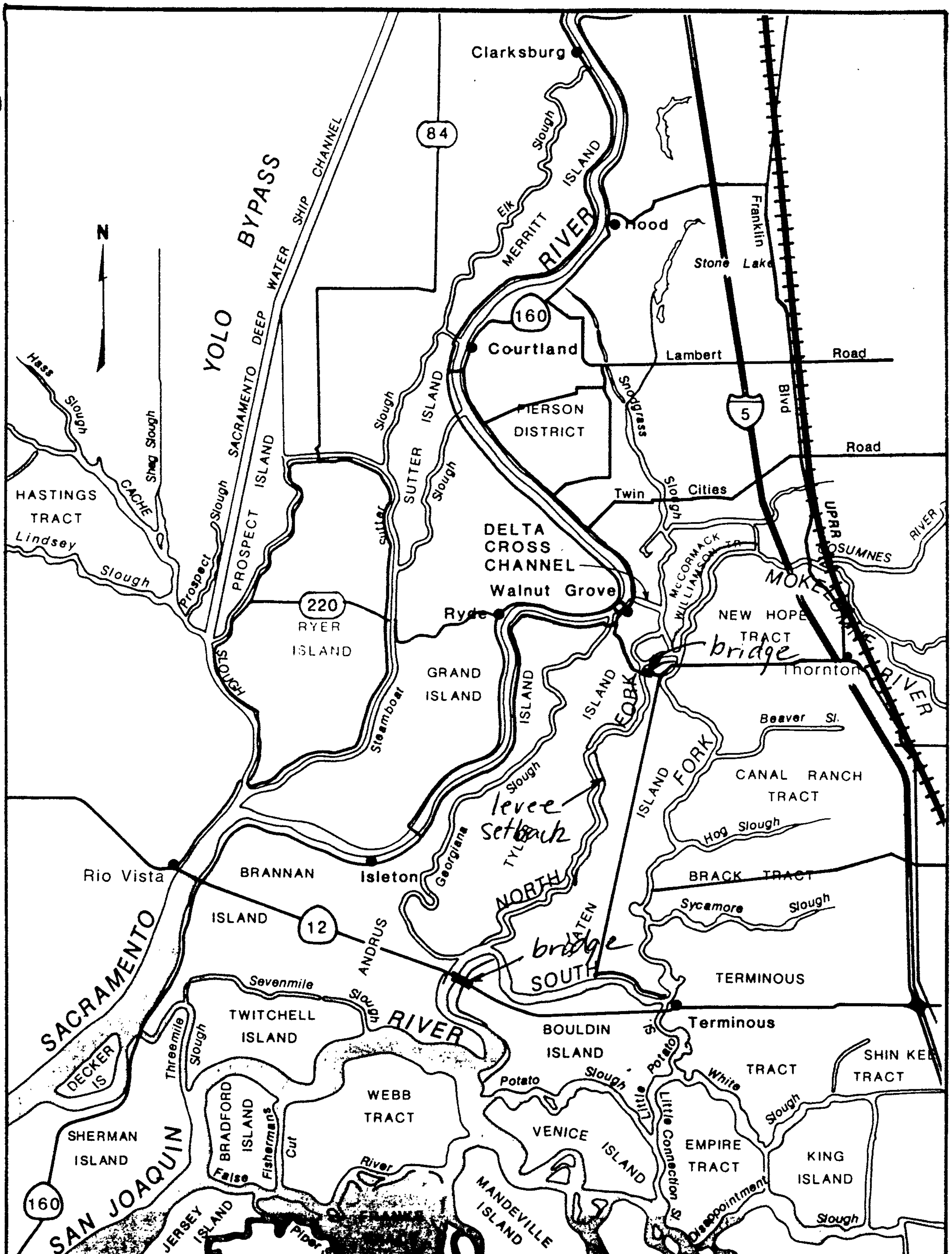

Figure 5. Levee Setbacks

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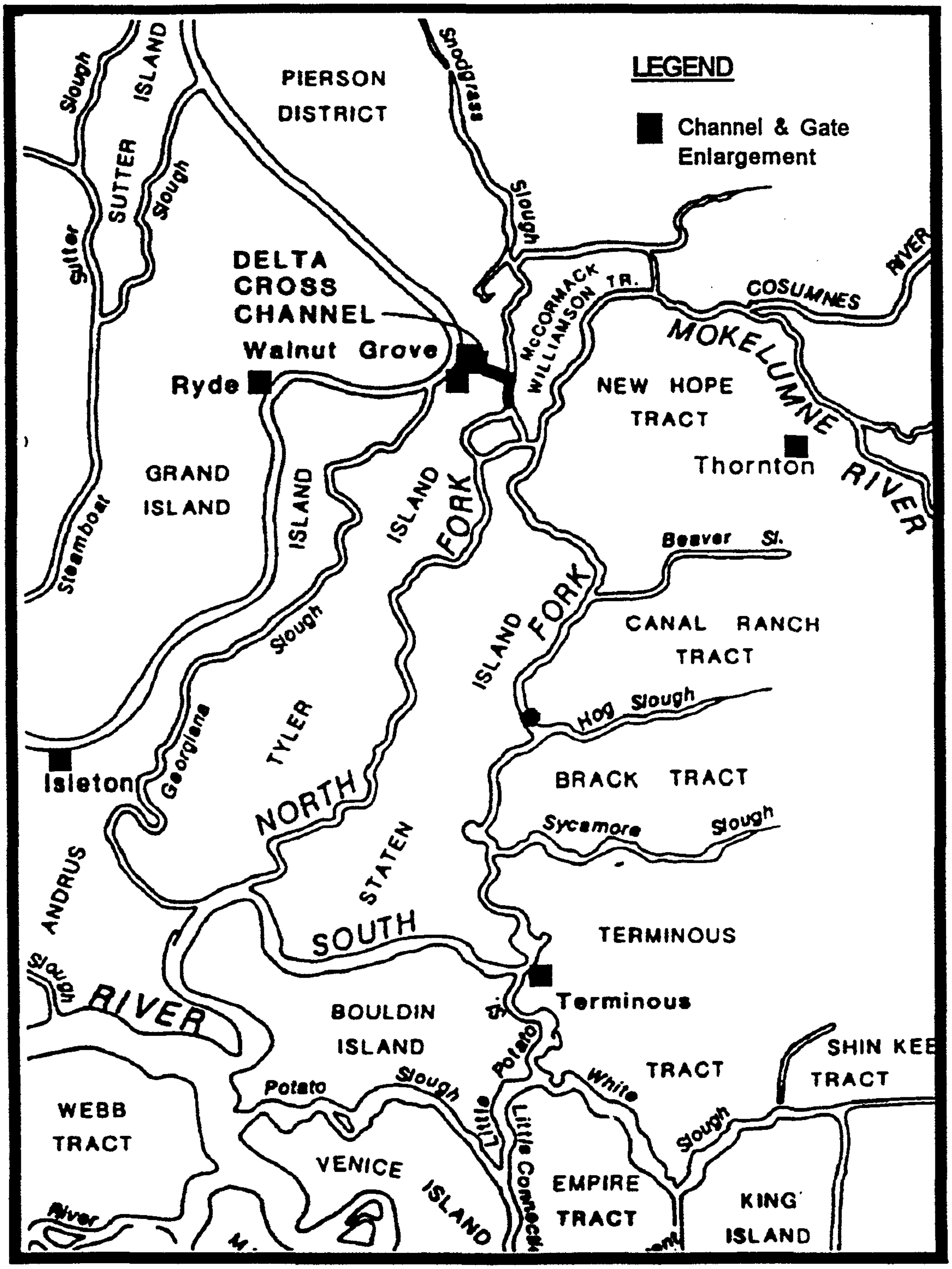

Figure 6. Delta Cross Channel Enlargement

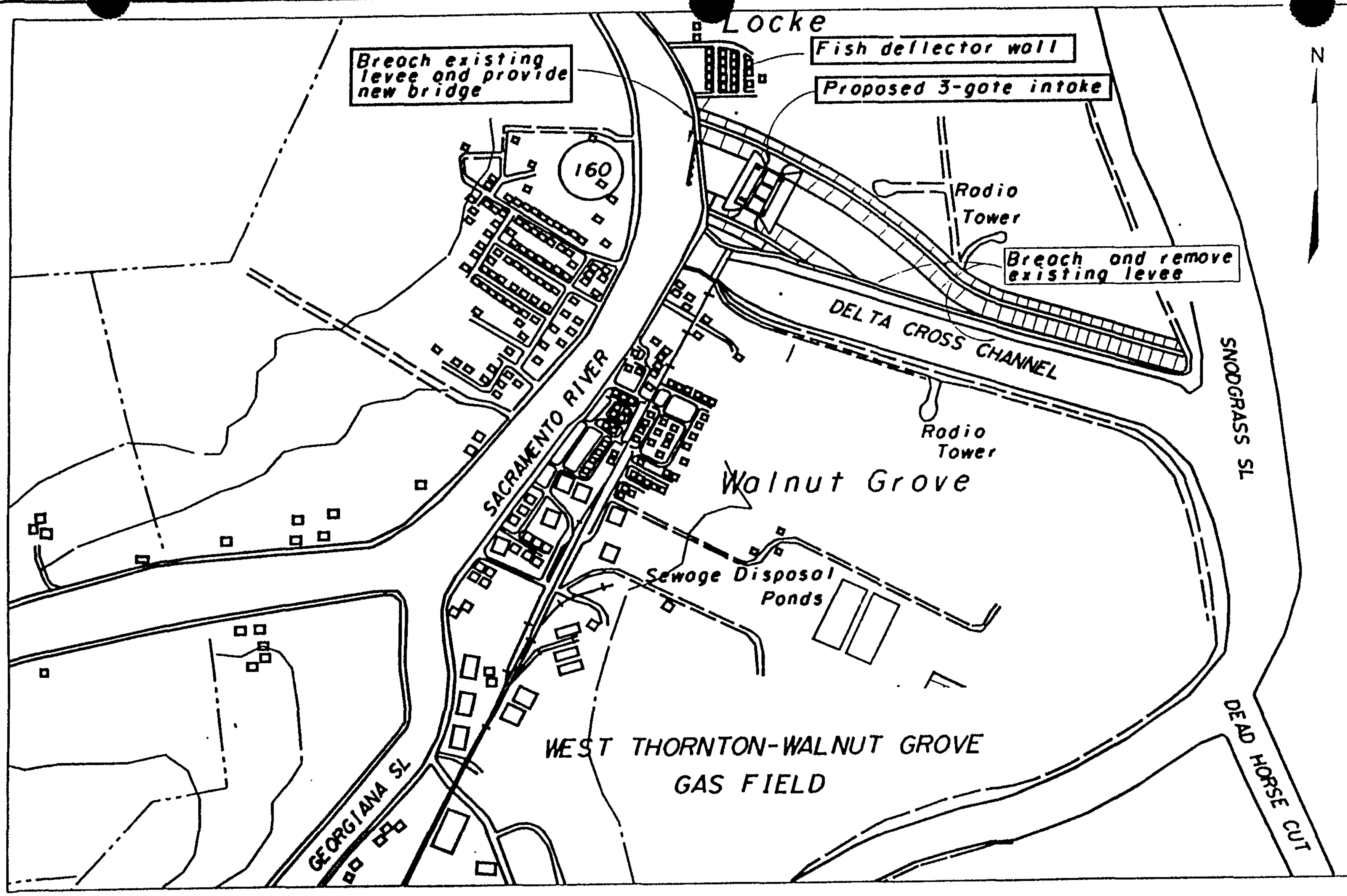

Figure 7. SITE MAP

DELTA CROSS CHANNEL

3-GATE ENLARGEMENT

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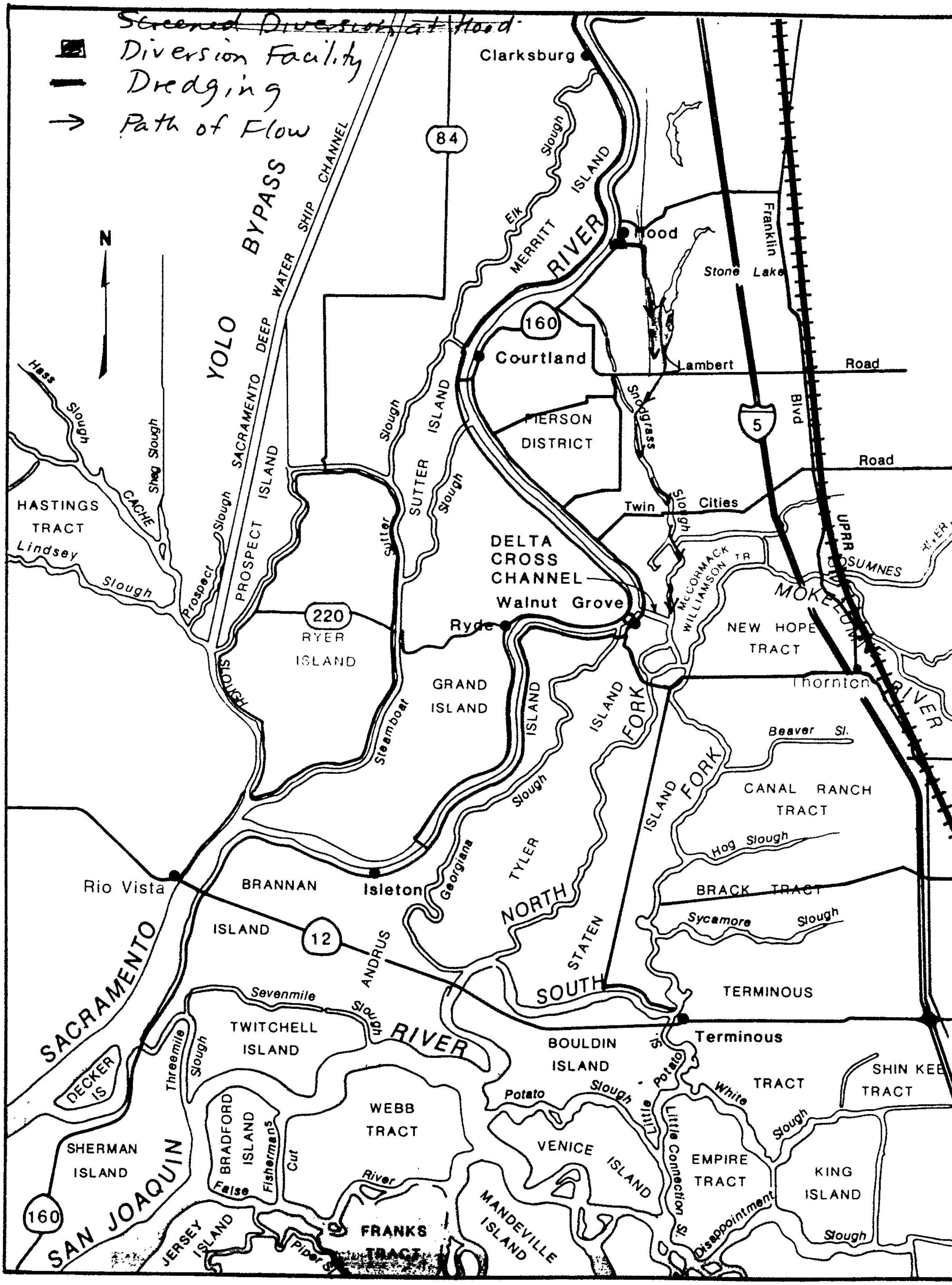

Figure 8. Screened Diversion at Hood

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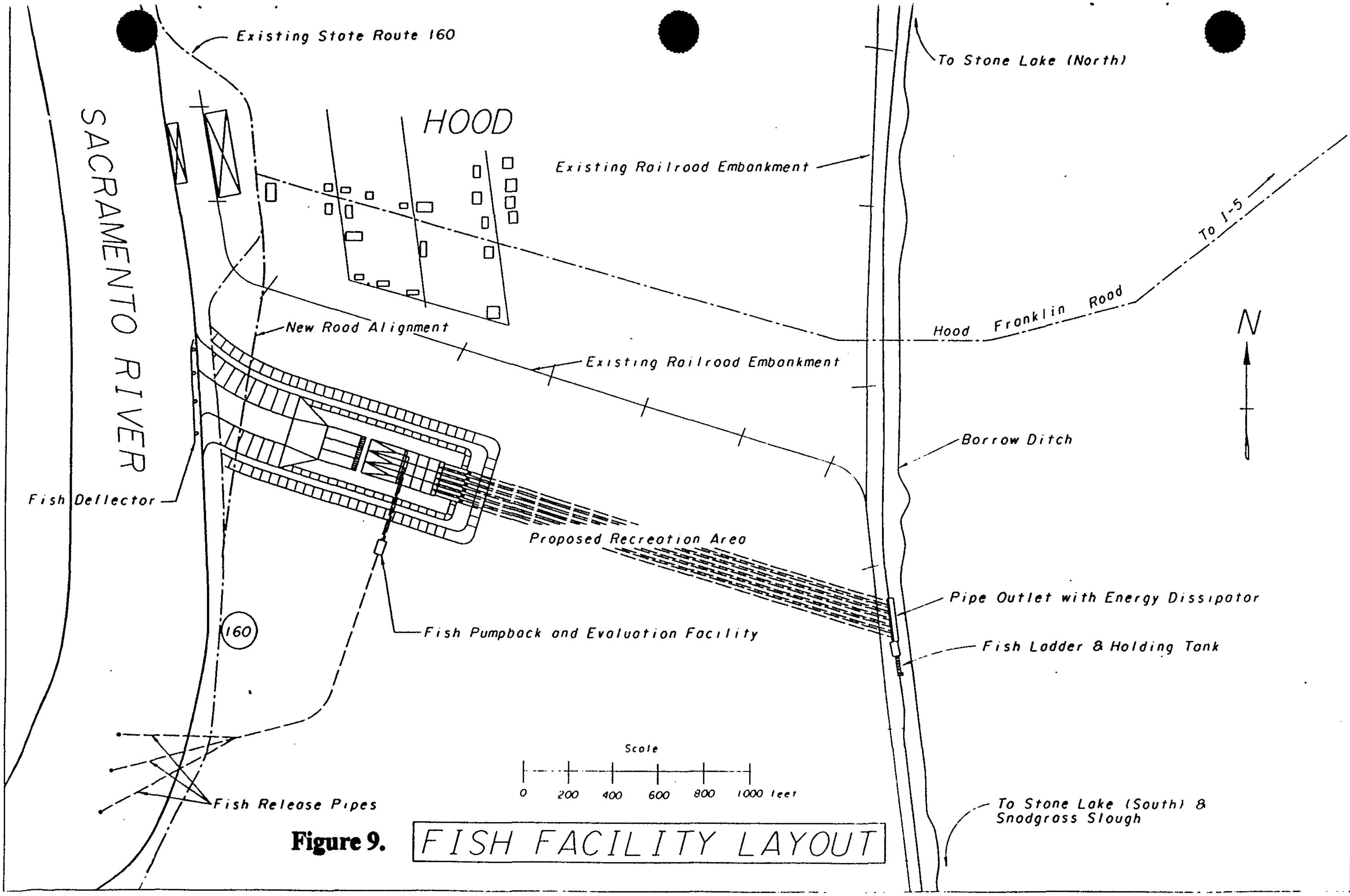

Figure 9. FISH FACILITY LAYOUT

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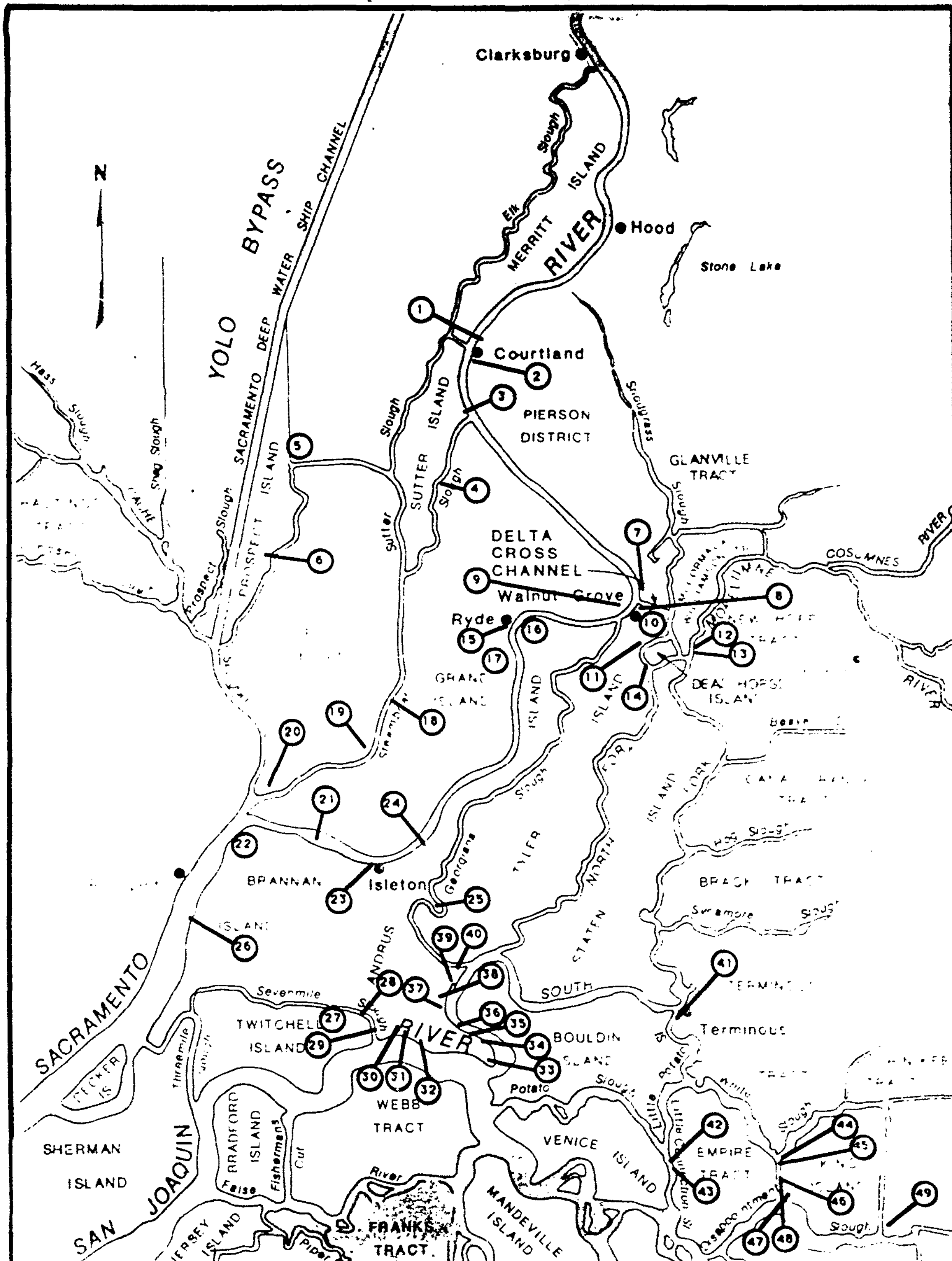


Figure 10. MARINAS/RECREATION AREAS

Table 1. MARINAS/RECREATION AREAS

Commercial Recreation Facilities, North Delta

1. Courtland Docks
2. Morgan's Landing
3. Steamboat Landing
4. Steamboaters Resort
5. Islands Marina
6. Golden Gate Island Resort
7. The Boathouse
8. Walnut Grove Merchants Dock
9. Deckhands
10. Delta Country Houseboats
11. Walnut Grove Marina
12. New Hope Landing
13. Wimpy's Marina
14. Giusti's
15. Ryde Hotel
16. Ko — Ket Resort
17. Tunnel Trailer Park
18. Sids Holiday Harbor
19. Snug Harbor
20. Hidden Harbor
21. Vieira's Resort
22. Cliff House
23. Ernie's
24. Riverside Inn & Marina
25. Ox Bow Marina
26. The Spot
27. Owl Harbor
28. Bruno's Island
29. Blue Heron Harbor
30. Spindrift Marina
31. Andreas Cove
32. Happy Harbor
33. Korth's Pirates Lair Marina
34. Moores Riverboat
35. Willow Berm Boat Harbor
36. Lighthouse Resort
37. Rancho Marina
38. Sycamore Park
39. Perry's Boat Harbor
40. B&W Resort Marina
41. Tower Park Marina
42. Camp - A - Float
43. Herman & Helen's
44. Uncle Bobbie's
45. King Islands Marina
46. King Island Houseboats
47. Holiday Flotels
48. King Island Resort
49. Paradise Point Marina

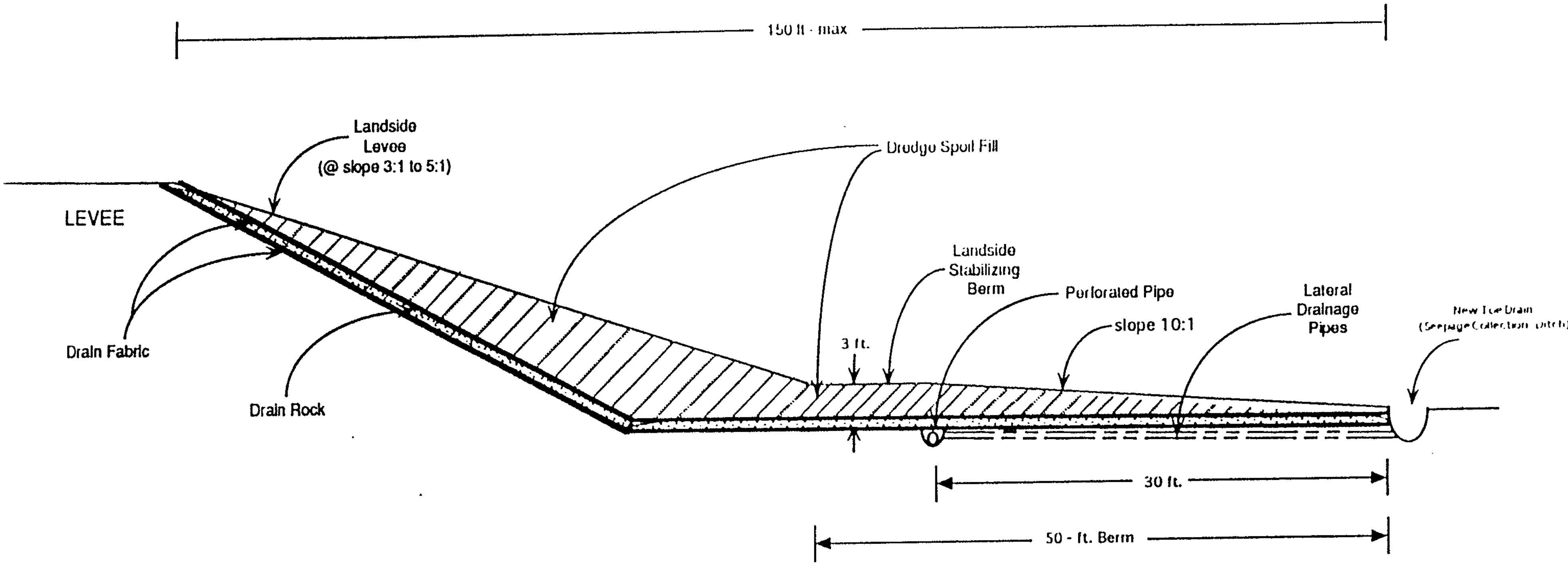
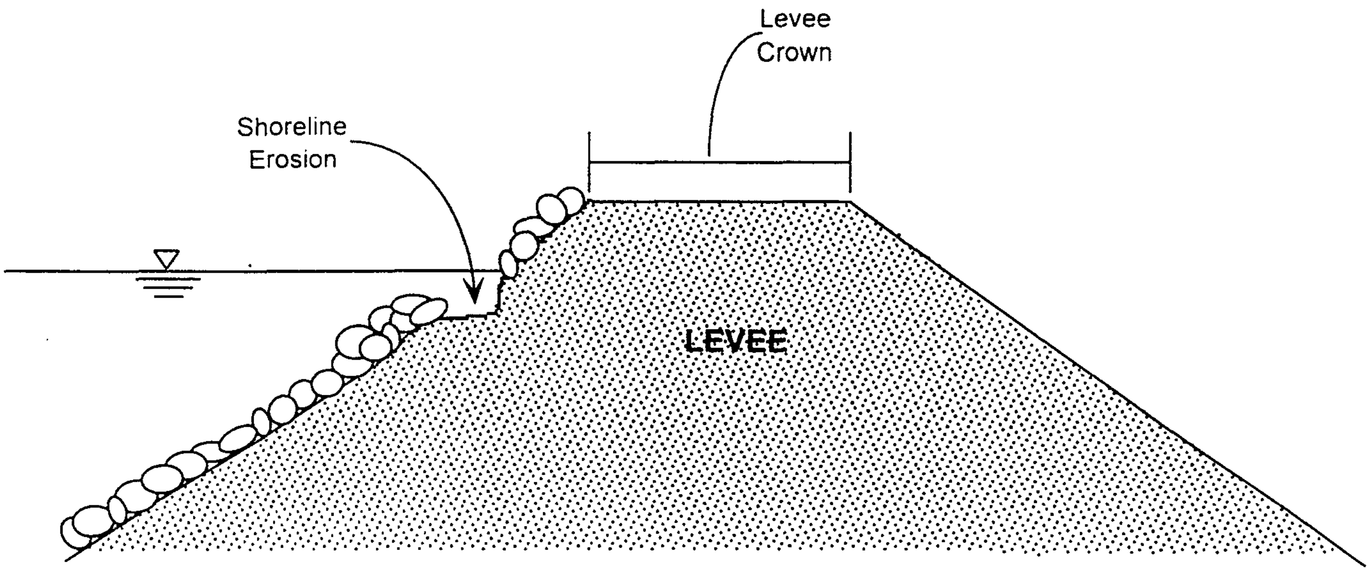
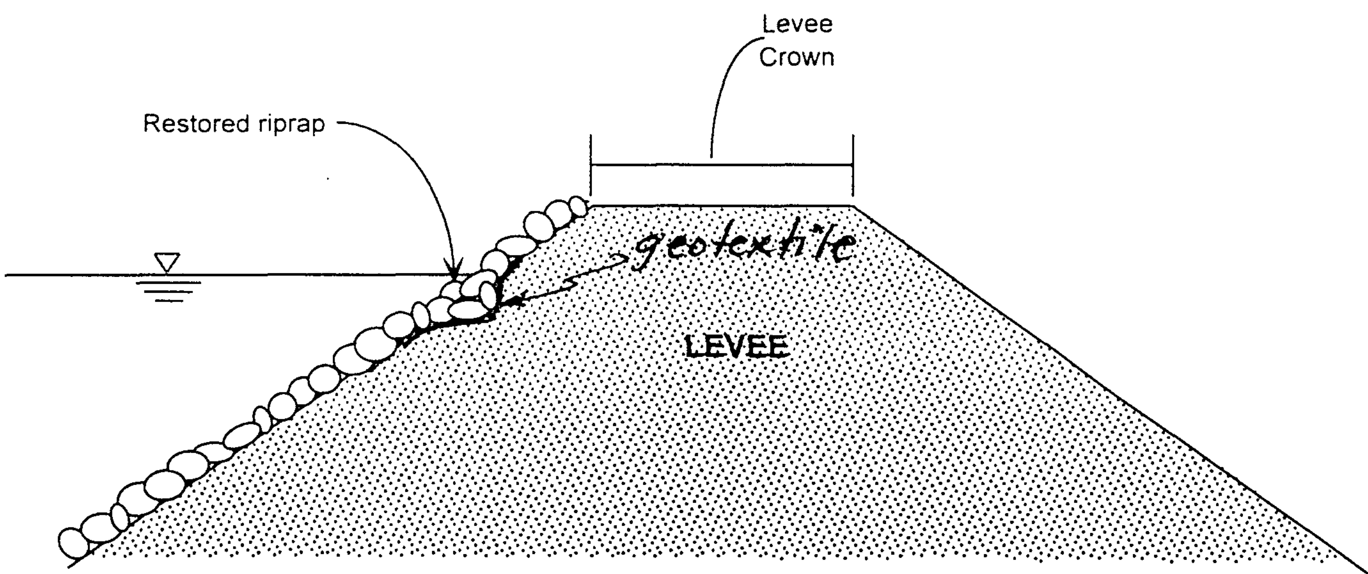


Figure 11. Levee Reinforcement



CONDITION A1 - Existing condition: Minor erosion on waterside levee slope



CONDITION A2 - Waterside levee slope restored

Figure 12. Erosion Protection

LEVEE SETBACKS

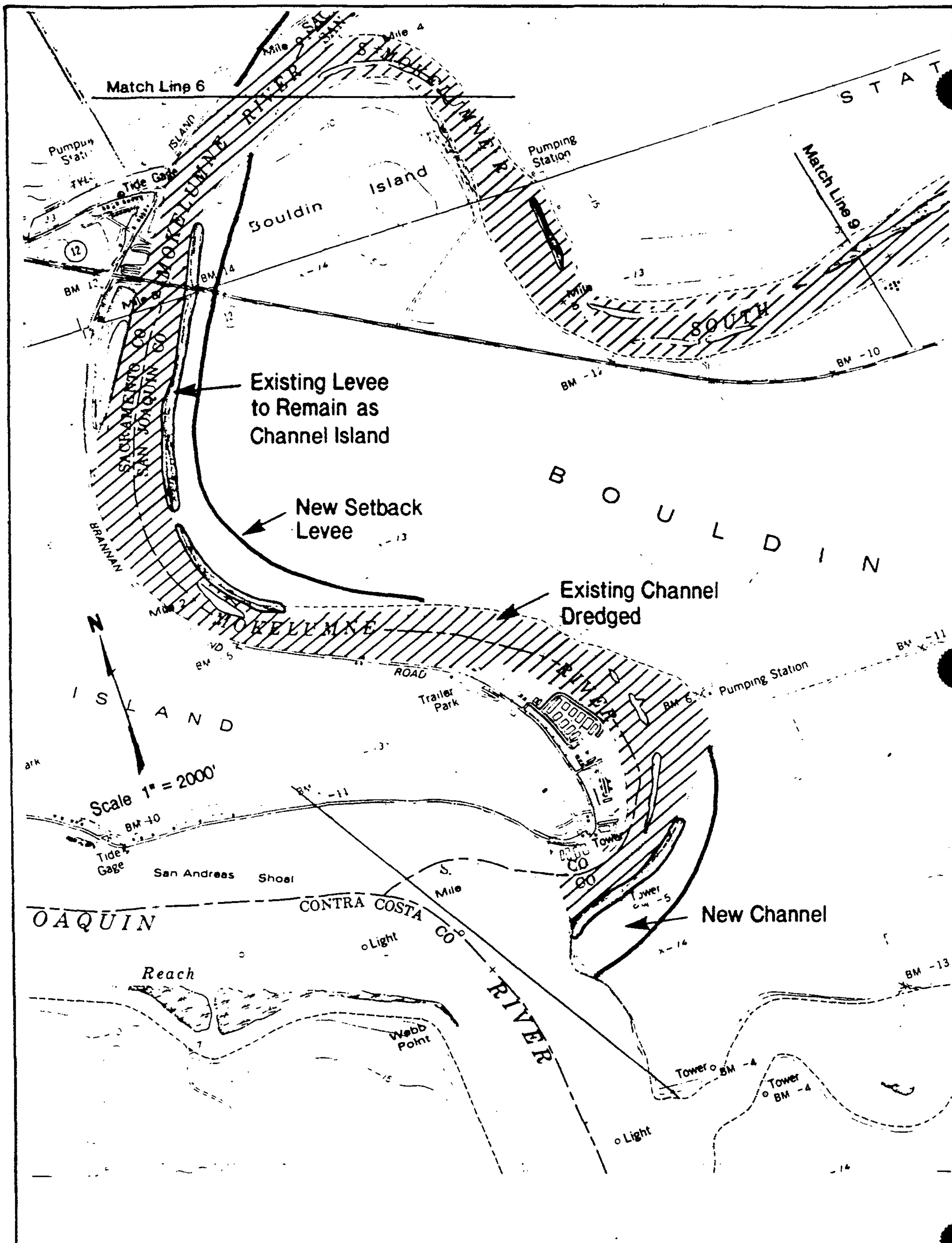


Figure 13. Levee Setbacks

LEVEE SETBACKS

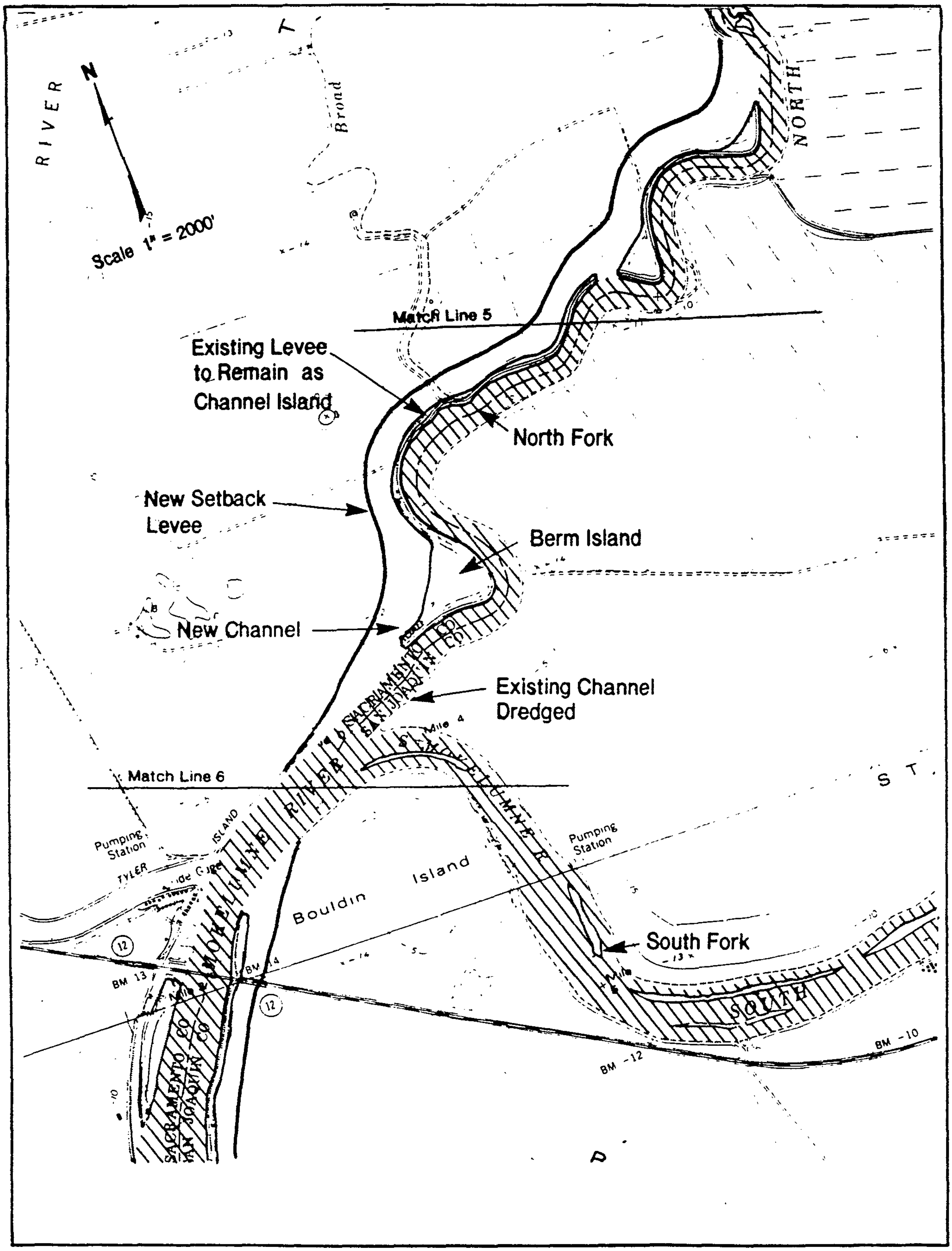


Figure 14. Levee Setbacks

LEVEE SETBACKS

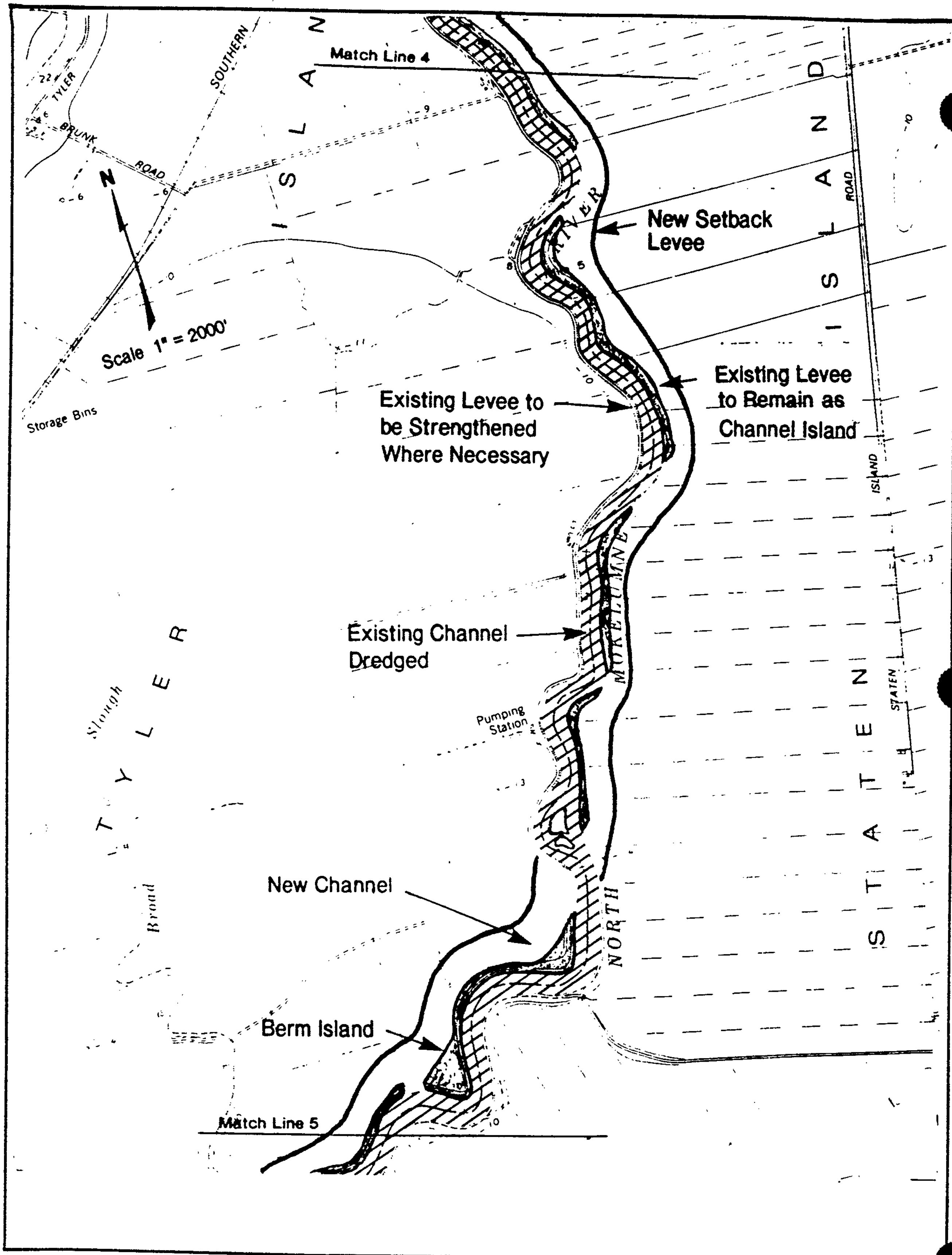


Figure 15. Levee Setbacks

LEVEE SETBACKS

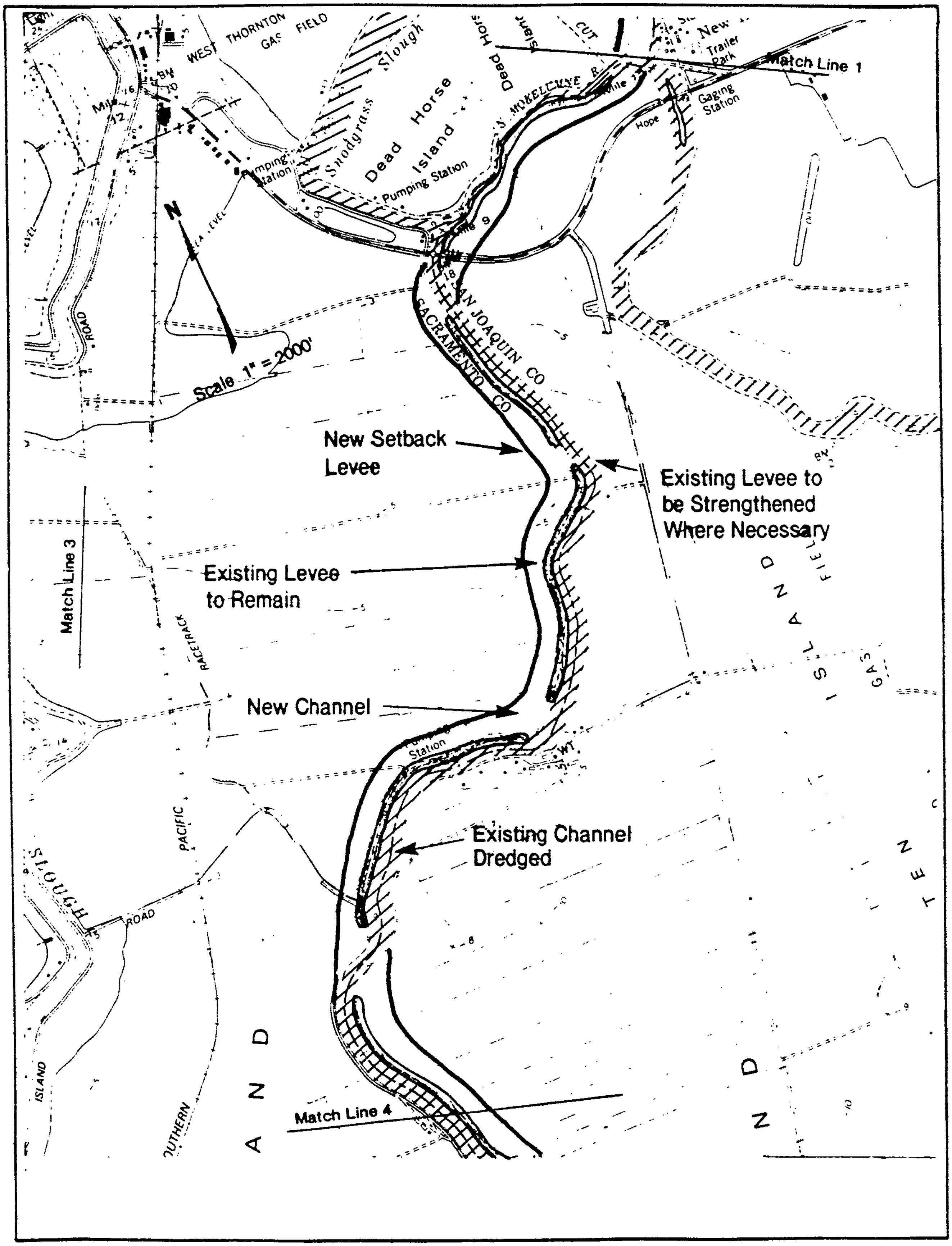


Figure 16. Levee Setbacks

LEVEE SETBACKS

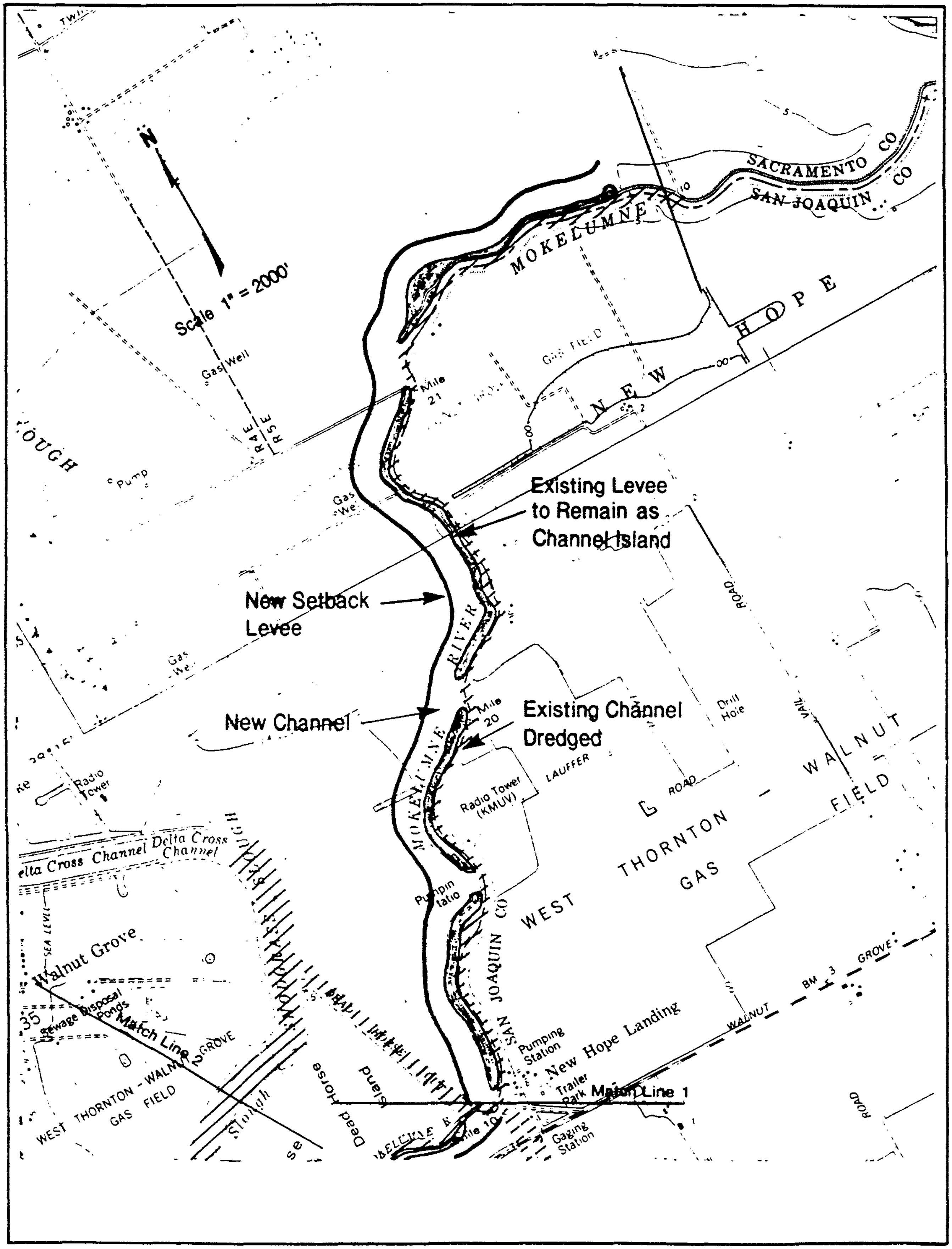


Figure 17. Levee Setbacks

NEW TWO-LANE BRIDGE ON THORNTON-WALNUT GROVE ROAD

Not To Scale: New Channel & Bridge

Scale: 1"=300'

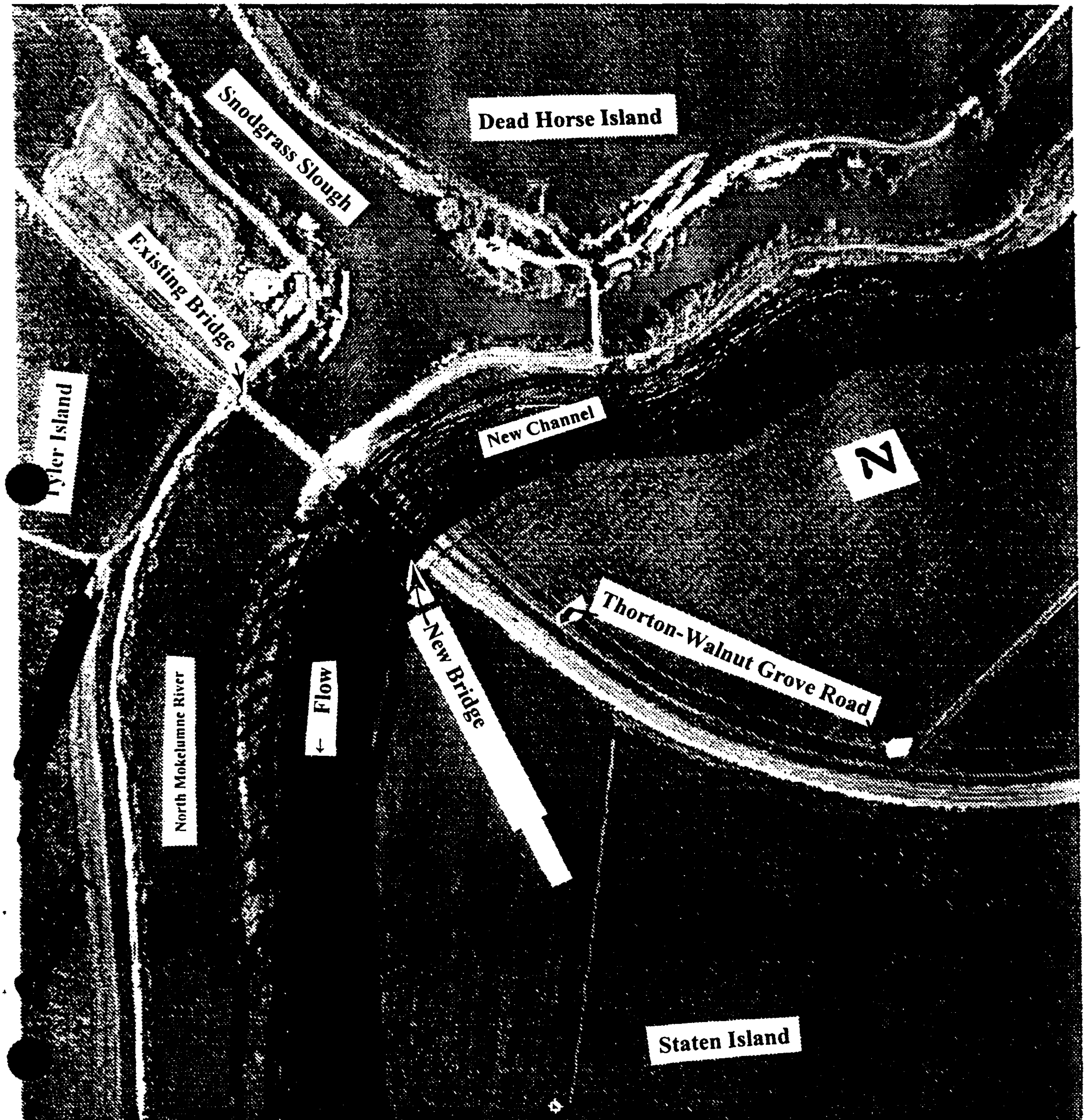


Figure 18. New Two-Lane Bridge on Thornton-Walnut Grove Road

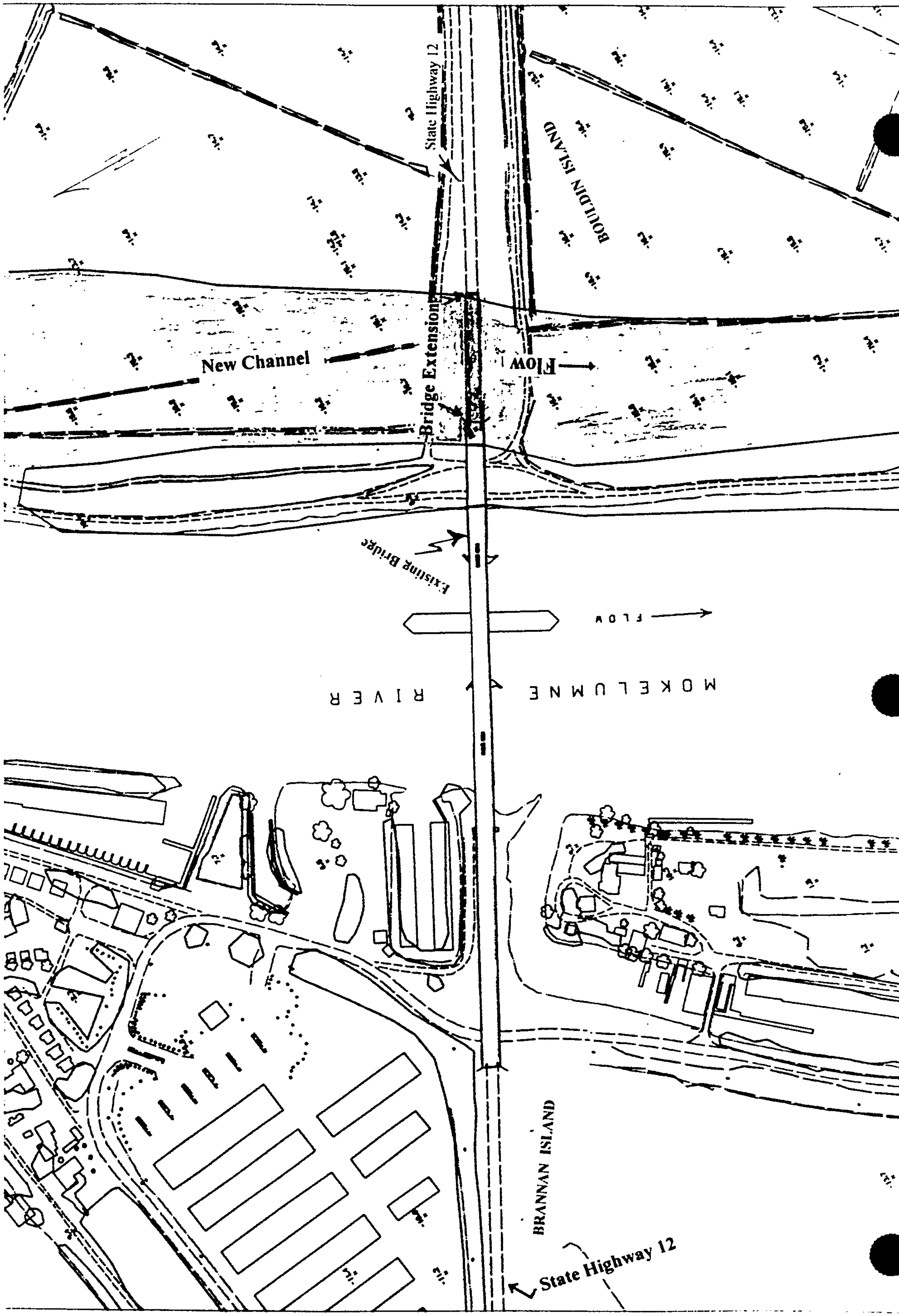


Figure 19. **Highway 12 Bridge Extension over Mokelumne River**

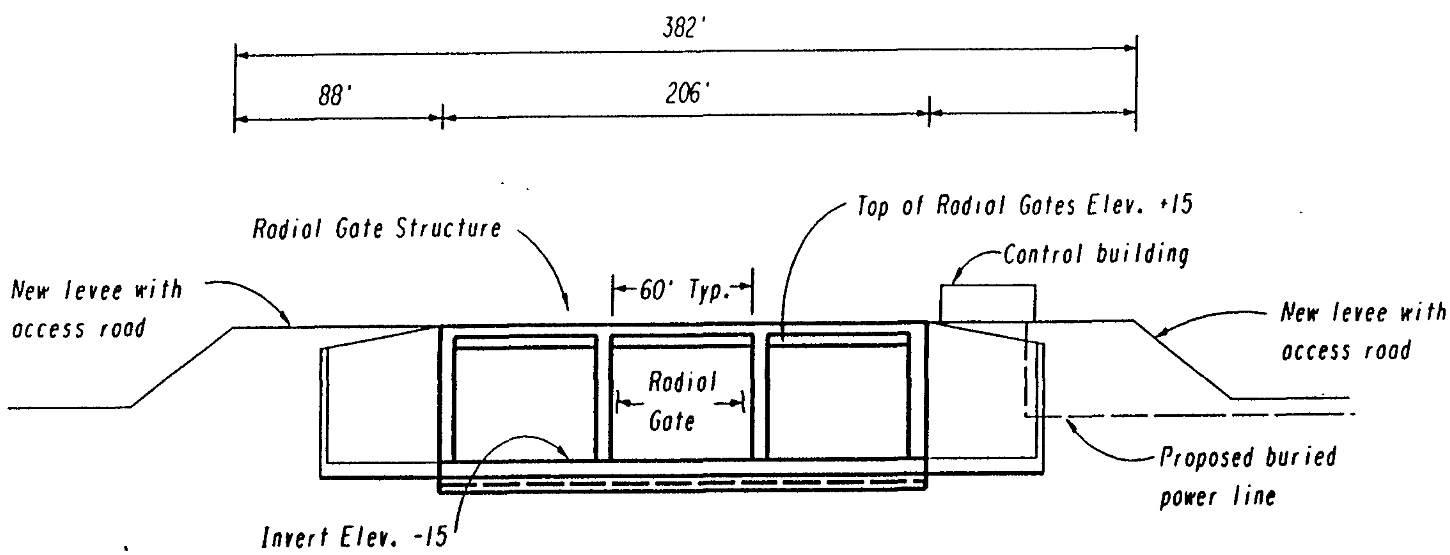


Figure 21. *ELEVATION VIEW*

DELTA CROSS CHANNEL
3-GATE ENLARGEMENT

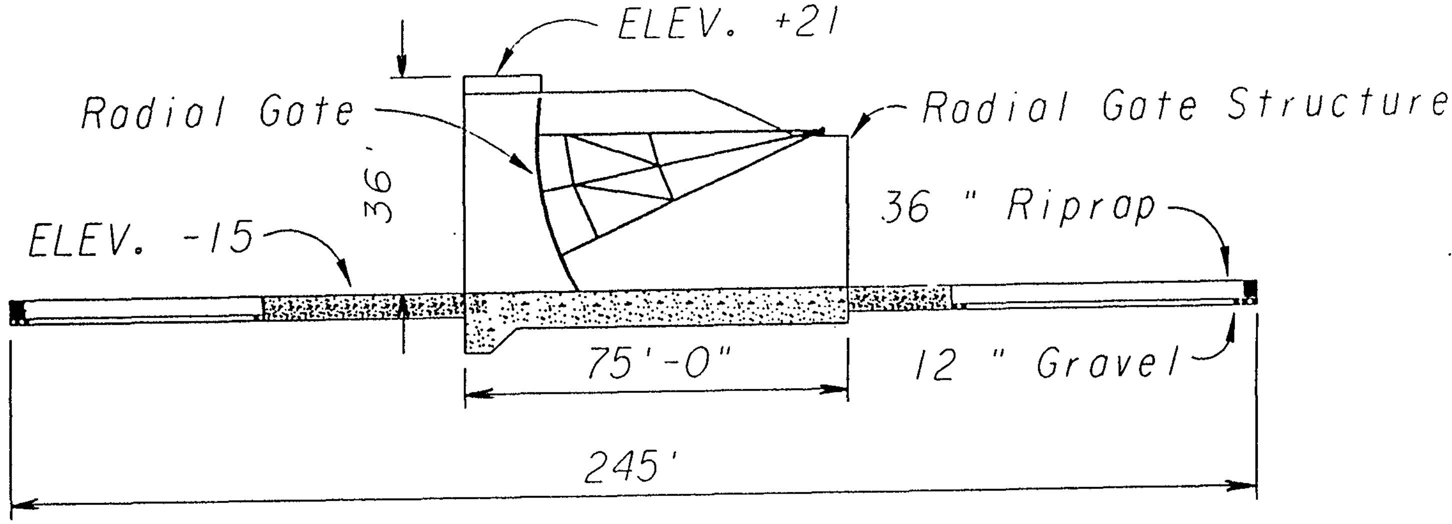


Figure 22. SECTION VIEW

DELTA CROSS CHANNEL
3-GATE ENLARGEMENT

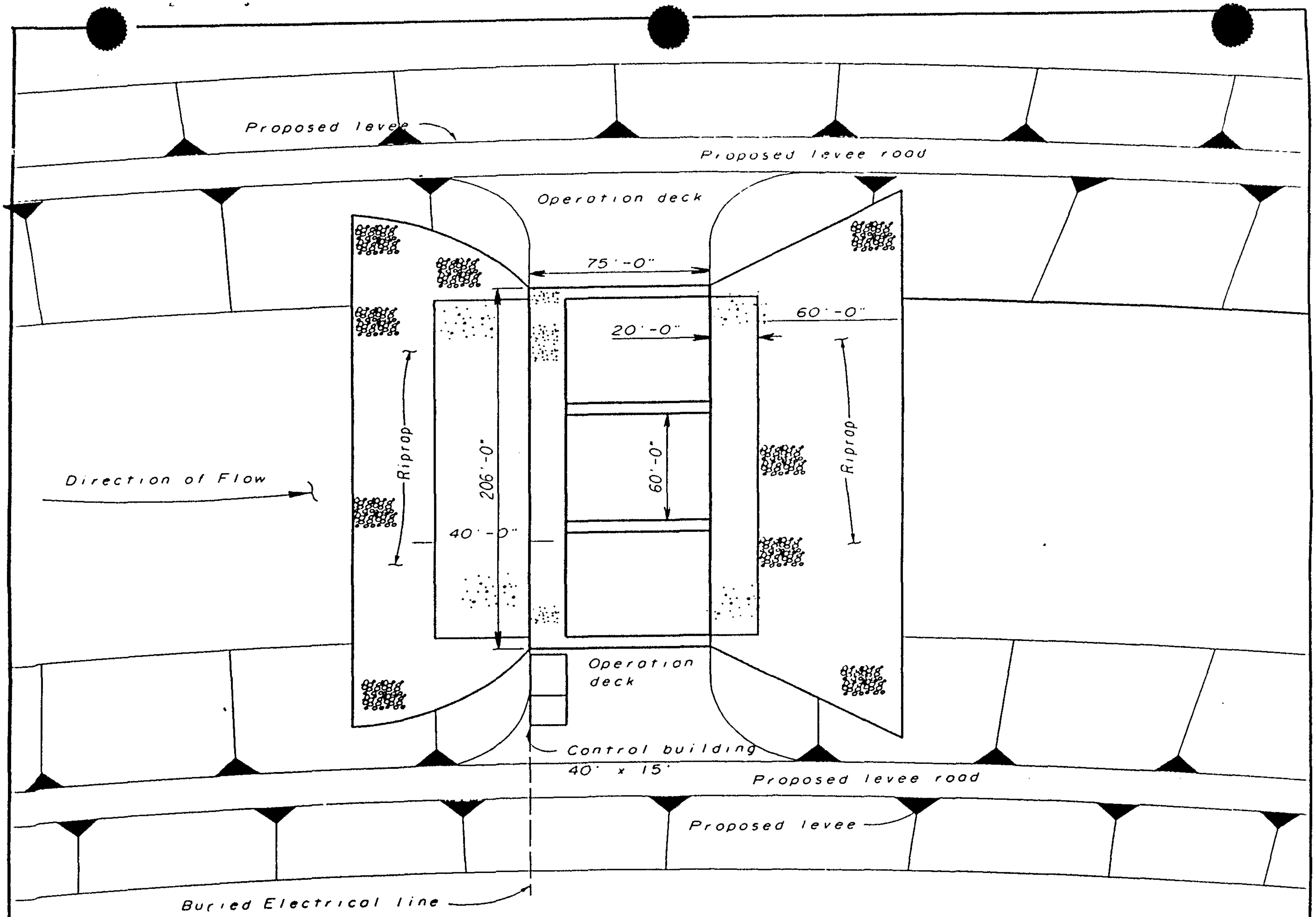


Figure 23. PLAN VIEW

DELTA CROSS CHANNEL
3-GATE ENLARGEMENT

D-002894

Table 2.

State of California
The Resource Agency of California
Department of Water Resources
Division of Design and Construction

PROJECT: DELTA CROSS CHANNEL IMPROVEMENT

Date: Mar-95
Price basis: Jan-95

ITEM	UNIT	QUANTITY	UNIT COST	ITEM COST
Box Girder Bridge	SF	19200	100.00	1,920,000
Radial Gate	EA	3	320,000	960,000
Excavation (structural)	CY	50000	4.12	206,000
Excavation (channel)	CY	225000	2.83	636,800
Backfill (structural)	CY	15400	18.13	279,200
Backfill (channel)	CY	75000	5.15	386,300
Riprap (36")	TON	11000	23.69	260,600
Riprap (24")	TON	17600	15.76	277,400
Bedding	CY	15900	13.70	217,800
Concrete (structural)	CY	8140	425.00	3,459,500
Steel (structural)	LB	1140000	0.55	627,000
Radial Gate Hoist	EA	6	130,000	780,000
Hand rail	LF	800	47.38	37,900
Business relocation	LS	1	515,000	515,000
Fish Deflector Wall	LS	1	465,000	465,000
Embankment	CY	180000	5.15	927,000
Transmission Tower Relocation	LS	1	5,150,000	5,150,000
TOTAL				17,106,000
Miscellaneous 20%				3,421,200
LOW BID COST				20,527,200
S/O - DESIGN, CONSTRUCTION SUPERVISION, AND CONTINGENCY @ 35 %				7,184,500
TOTAL FIRST COST				27,712,000

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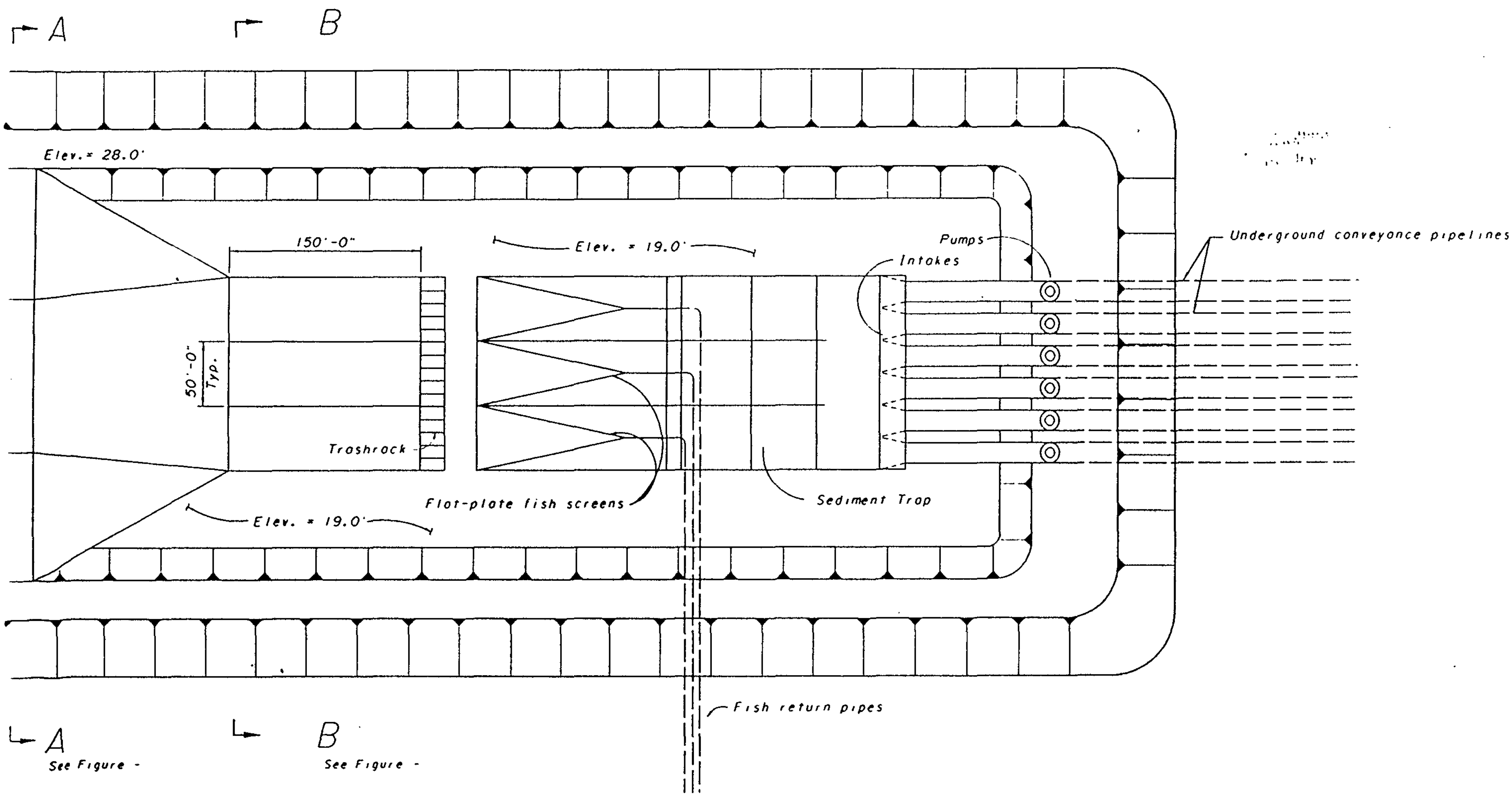

PLAN

No Scale

NOTES

1. For detail plan of fish screens see figure -
2. For elevation view of fish screens see figure -

Figure 24. Fish Screens, Plan view

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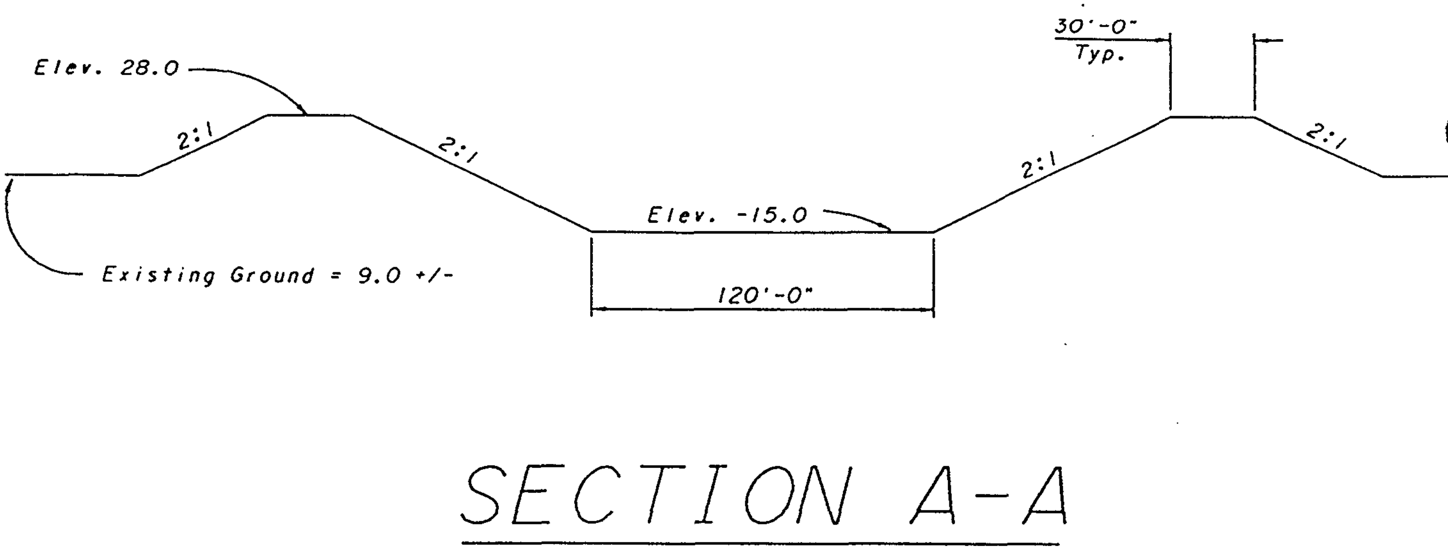

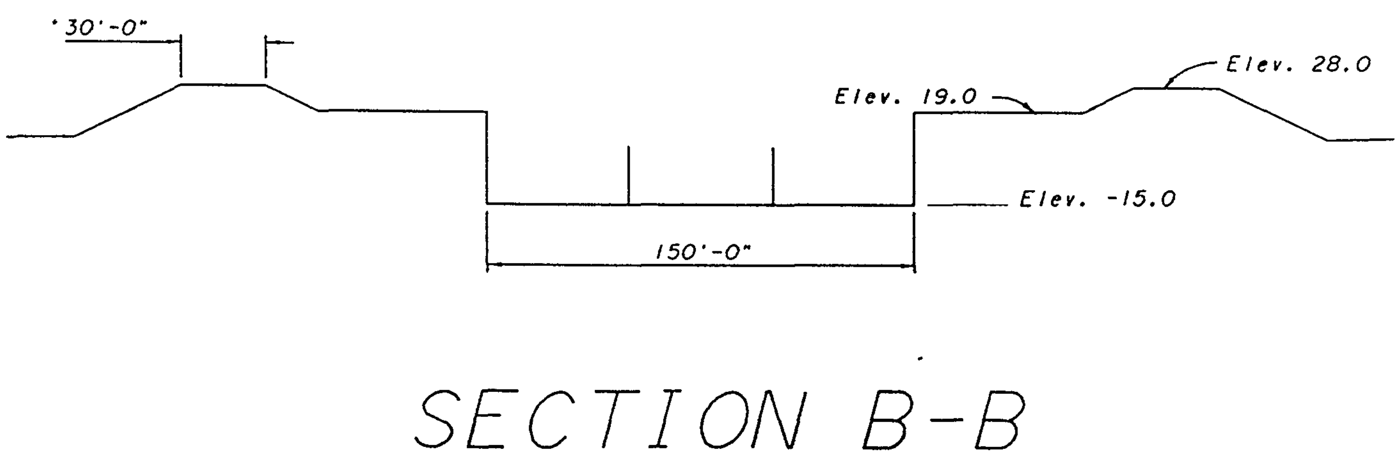

Figure 25. Sections, Screened Diversion Structure

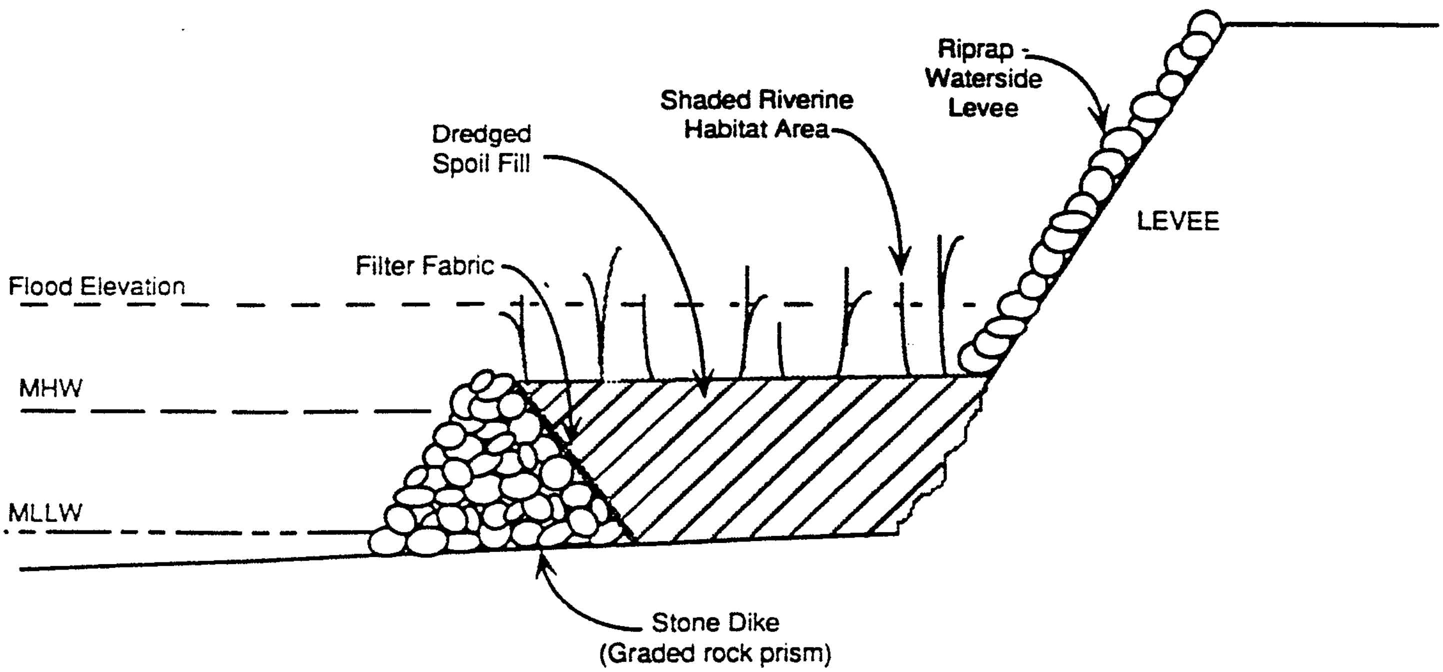

Figure 26. Waterside Berm, Typical Section

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