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OPERATIONS BRANCH
FLOOD CONTROL SECTION

Volume 4

OPERATION AND MAINTENANCE MANUAL AMERICAN RIVER FLOOD CONTROL PROJECT

AMERICAN RIVER - PART NO. 1 LEVEE CONSTRUCTION FROM CARMICHAEL BLUFFS DOWNSTREAM 8.3 MILES

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

Incl 1

CORPS OF ENGINEERS

U. S. ARMY

OPERATION AND MAINTENANCE MANUAL
FOR
AMERICAN RIVER - PART NO. 1
LEVEE CONSTRUCTION
FROM
CARMICHAEL BLUFFS DOWNSTREAM 8.3 MILES

Sacramento District
Corps of Engineers
U. S. Army

November 1959

POPERATION AND MAINTENANCE MANUAL
AMERICAN RIVER FLOOD CONTROL PROJECT

AMERICAN RIVER – PART NO. 1

LEVEE CONSTRUCTION
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LOCATION	ADDITION OR REVISION	DATE
Exhibit F	Add copy of letter of transfer dated 17 Nov 1958	23 Mar 2010
Paragraph 4-04.a	Revised to include R4 structure	01 Jul 2010
Paragraph 4-05.a.(4)	Slurry Wall Facilities added	01 Jul 2010
Paragraph 4-05.a.(4)(a)	Site R4 added	01 Jul 2010
Paragraph 4-05.b.(5)	Site R4 added	01 Jul 2010
Exhibit B	Revised to include R4 structure	01 Jul 2010
Exhibit F	Add copy of letter of transfer dated 01 Jul 2010	01 Jul 2010

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FROM
CARMICHAEL BLUFFS DOWNSTREAM 8.3 MILES
SACRAMENTO COUNTY, CALIFORNIA
OPERATION AND MAINTENANCE MANUAL

SECTION I
INTRODUCTION

1-01. Authorization. The American River Levee Project was authorized by the Flood Control Act of 3 September 1954, Public Law 780, Eighty-third Congress, Second Session, Section 203, which reads in part as follows:

> "Sacramento River Basin . . . The plan of improvement for flood control on the American River, California, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers, in House Document Number 367, Eighty-first Congress, at an estimated cost of $1,600,000 for levees."

1-02. Location. The American River levee, as covered by this manual, lies in the Sacramento Valley near the City of Sacramento. It extends along the northerly bank of the American River from the Hidden River Vista residential subdivision, just southerly of the town of Carmichael, downstream about 8.3 miles to the upper end of the Sacramento River Flood Control Project (near the intersection of Howe Avenue and Arden Way). The American River rises on the west slope of the Sierra-Nevada Mountain Range and flows in a general westerly direction to its junction with the Sacramento River at the City of Sacramento, California. The project location is indicated on Drawing No. 1-4-415, sheet 1 of Exhibit B and on location map of Exhibit A-1, inclosed herewith.

1-03. Description of the Project Works. The project works covered by this manual includes the right bank of the American River from Carmichael Bluffs downstream about 8.3 miles to the existing Sacramento River Flood Control Project levee.

A separate manual designated as American River - Part No. 2 will cover operation and maintenance of two pumping plants constructed in conjunction with the levee for this project.

Bank protection work performed along the left bank of the American River in the vicinity of the H Street Bridge at the same time as the right bank levee was constructed will be covered in a separate manual No. 118-2.

1-04. Protection Provided. The project work was designed to protect 2,200 acres of adjacent agricultural land, several commercial installations, a rapidly developing suburban area, and a state highway which is one of three easterly approaches to the City of Sacramento. Most of the agricultural land lying upstream of the H Street Bridge and adjacent to and northerly of the river in the project area is included in Reclamation District No. 2077. The project design flood is 115,000 cubic feet per second (the project release from the upstream Folsom Reservoir). In accordance with the desires of local interests, the levee heights were so set as to provide a freeboard of not less than five feet above the design flood plane. Further, since the left bank levee was already higher than the criterion would require, the project levee freeboard was increased, where required, to provide the same protection as that provided by the left bank levee at the point where it would first be over-topped in a greater-than-design flood. Such increase in project levee height was found applicable to the reach upstream of the H Street Bridge. Downstream, such increase was not applicable. With a minimum freeboard of 3 feet, the project would be capable of carrying about 152,000 cubic feet per second (a possible peak release from Folsom Reservoir during a Standard Project Flood). As shown on the drawings of Exhibit B, the grade of the adopted flood plane profile varies from elevation 64.6 at centerline station 28+05 on the upper end near Carmichael Bluffs to elevation 40.8 at centerline station 446+00 at the lower end of the project. All elevations are referred to U. S. Corps of Engineers datum.

1-05. Construction Data and Contractor. Part of the right bank levee of the American River within the project was built by local interests at various times and in various parts but no records of such construction are available. Construction contracts required by the Corps of Engineers to bring the right bank levee of the American River to project standards were as follows:

a. Emergency levee repairs and bank protection along the north levee of the American River above the H Street Bridge was accomplished under Contract No. DA-04-167-eng-416 by J. R. Reeves and completed on 19 February 1951.

b. Levee construction and bank protection work required to complete the right bank of the American River levee within the project was accomplished under Contract No. DA-04-167-CIVENG-57-136 by A. Teichert and Son, Inc., contractor, during the period from 15 May 1957 to 7 November 1958.

1-06. Flood Flows. For purposes of this manual, the term "flood" or "high water period" for the American River within this project shall refer to flows when the water surface in the river reaches or exceeds the reading of 40.0 feet on the U. S. Geological Survey and State Department of Water Resources gage located on the H Street Bridge over the American River. Zero of the H Street gage is set on 0.00 U. S. Corps of Engineers datum and minus 3.07 feet U. S. Geological Survey datum.

SECTION II

LOCAL COOPERATION REQUIREMENTS

2-01. Requirements of Local Cooperation. House Document No. 367, Eighty-first Congress, First Session, requires local interests to (a) Provide free of cost to the United States all necessary rights-of-way, (b) hold and save the United States free from damage claims due to construction, and (c) after completion, maintain and operate the levees, channels and appurtenant works under rules and regulations prescribed by the Secretary of the Army.

Authorizing legislation by the State of California is contained in Section 12648.1 of the State Water Code and is quoted as follows:

> "12648.1. The plan of flood control on the American River is hereby authorized and adopted substantially in accordance with the recommendations of the Chief of Engineers, House Document Numbered 367, Eighty-first Congress, and adopted and authorized by the act of Congress approved August 17, 1954, at an estimated state cost of five hundred thousand dollars ($500,000). Said project shall be considered as extending and supplementing the projects authorized pursuant to Section 12648. Section 12828 shall not be applicable to the project."

2-02. Assurances Provided by Local Interests. The State of California by legislation enacted in 1955 has agreed to furnish the required cooperation. Section 12657 of the State Water Code states:

> "12657. Except as otherwise provided in Chapters 1 and 2 of this part, the Reclamation Board shall give assurances satisfactory to the Secretary of War that the local cooperation required by Section 3 of the act of Congress approved December 22, 1944 (Public, numbered 534, Seventy-eighth Congress, Second Session), and Section 2 of the act of Congress approved August 18, 1941, (Public, numbered 228, Seventy-eighth Congress, First Session), will be furnished by the State in connection with the flood control projects authorized and adopted in Sections 12648, 12650, 12651, 12652, 12654 and 12656.5 and on any flood control projects on any stream flowing into or in the Sacramento Valley or the San Joaquin Valley hereafter approved and authorized by Congress."

2-03. Acceptance by State Reclamation Board. Responsibility for operating and maintaining the completed works was officially accepted by the Reclamation Board of the State of California by letters dated 19 December 1958 and 21 January 1959, as shown on the attached letters of acceptance, Exhibit F.

SECTION III

MAINTENANCE AND OPERATION - GENERAL PROCEDURE

3-01. Reference to Approved Regulations. This manual is submitted in accordance with provisions of Title 33 - Navigation and Navigable Waters, Chapter II, Corps of Engineers, Department of the Army, Part 208 - Flood Control Regulations, Maintenance and Operation of Flood Control Works, approved by the Secretary of the Army, 9 August 1944, and published in Federal Register, 17 August 1944, a copy of which is included as Exhibit A, Sheets 1 and 2.

3-02. Intent of Regulations. The general intent of the regulations approved by the Secretary of the Army is stated in paragraph 208.10(a)(1) as follows: "The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

The principle mission of the Corps of Engineers, during flood emergencies, is to insure that flood control works are properly operated and maintained and offer technical advise to enable local interests to obtain maximum flood protection. All other matters become secondary and will yield precedence to the accomplishment of the above-stated missions. During flood periods local interests maintain close liaison with the office of the District Engineer, Corps of Engineers. However, in the event it is evident that all available county and local resources are insufficient to cope with the situation and the necessity for an emergency proclamation is anticipated, requests for State assistance in flood fighting should properly be made direct to the Division of Water Resources, which is the State agency designated by the Directors of Public Works, to receive requests from local agencies for assistance in flood fighting. This agency is authorized to request Federal assistance from the Corps of Engineers when State and local resources are insufficient to cope with the situation. Therefore, it is desired to emphasize that requests for Federal assistance in flood fighting should be made only when it is evident that County, State and/or other local equipment and manpower will be exhausted and local resources are insufficient to cope with the flood emergency situation.

3-03. Purpose of this Manual. In view of the large number of local flood protection projects authorized by Congress and the repetitious nature of regulations to govern maintenance and operation of each individual project, and in order that local interests may be fully aware of the extent of the obligations assumed by them in furnishing assurances of local cooperation for projects to be constructed in the future, the general regulations described above were established by the Secretary of the Army. The general regulations approved by the Secretary of the Army, August 1944, were intended to be sufficiently broad in scope and general in nature as to be applicable to all flood-protect-projects for which such regulations are required by law.

Section 208.10(a)(10) of the regulations read as follows: "The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations." This manual has, therefore, been prepared to furnish local interests with information on the project works and advise as to the details of the operation and maintenance requirements applicable to this particular project, to state procedure required by the Department of the Army, and to indicate satisfactory methods of flood-fighting operations and emergency repairs. The project works are to be maintained and operated in accordance with the Flood Control Regulations referred to above and interpretations thereof contained herein.

3-04. Definitions. As used hereinafter, the term "Superintendent" shall be defined to mean the person appointed by local interests to be directly in charge of an organization which will be fully responsible for the continuous inspection, operation, and maintenance of the project works; the term "District Engineer" shall be defined to mean the District Engineer of the Sacramento District, Corps of Engineers, U. S. Army, or his authorized representative. The term "flood" shall mean any flow when the water surface reaches or exceeds the reading of 40.0 on the U. S. Geological Survey and State Division of Water Resources gaging station located on the H Street Bridge over the American River. The term "right bank" or "left bank" shall be defined to mean the right or left bank or side, respectively, of a stream or channel when facing downstream.

3-05. General Provisions of Regulations. In addition to that quoted in paragraph 3-02 above, the general provisions of the Flood Control Regulations, contained in paragraphs 208.10(a)(2) to 208.10(a)(9), both inclusive, are quoted as follows:

> "(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of, or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of an organization responsible for the efficient operation and maintenance of all structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.
>
> (3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way of the protective facilities.

(5) No improvement shall be passed over, under or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any features of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer, or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the works.

(6) It shall be the duty of the Superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representative shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary, shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

3-06. Assistance to be Furnished by the District Engineer. The District Engineer will:

a. Furnish to the Superintendent "As Constructed" drawings of the project works at the time they are transferred.

b. Make periodic inspections of the project works and notify the Superintendent of any repairs or maintenance measures which the District Engineer deems necessary in addition to the measures taken by the Superintendent.

c. Submit to the Office, Chief of Engineers, all cases of non-compliance with full details thereof for determination of corrective measures to be taken.

d. Make prior determination that any proposed encroachment, improvement, excavation, or construction within the right-of-way, or alteration of the project works, will not adversely affect the functioning of the protective facilities, and to furnish the Superintendent with an approval thereof in writing.

e. Assist the Superintendent as may be practicable, in his duties of ascertaining storm developments having flood-producing potentialities, assembling flood-fighting forces and materials, and initiating and carrying out flood-fighting operations.

3-07. Responsibilities of the Superintendent. In line with the provisions of the Flood Control Regulations, the general duties of the Superintendent include the following:

a. Training of Key Personnel. Key personnel shall be trained in order that regular maintenance work may be performed efficiently and to insure that unexpected problems related to flood control may be handled in an expeditious and orderly manner. The Superintendent should have available the names, addresses, and telephone numbers of all his key men and a reasonable number of substitutes. These key men should, in turn, have similar data on all of the men who will assist them in the discharge of their duties. The organization of key men should include the following:

(1) An assistant to act in the place of the Superintendent in case of his absence or indisposition.

(2) Sector foremen in sufficient number to lead maintenance patrol work of the levee, inspect the channel, and operate the gate structures properly during flood periods. High qualities of leadership and responsibility are necessary for these positions.

b. Files and Records. The Superintendent shall maintain a file of reports, records, and drawings concerning the project works, readily available at all times to the District Engineer.

c. Encroachment or Trespass on Right-of-Way. In accordance with the provisions of Flood Control Regulations 208.10(a)(4), no encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted on the rights-of-way for the protective facilities. The Superintendent will, therefore, cause notices to be posted at conspicuous places along the project right-of-way directing public attention to this regulation. The Superintendent shall arrange for the prosecution of offenders under local ordinances and report action taken to the State Reclamation Board.

d. Permits for Right-of-Entry or Use of Portion of Right-of-Way. Permits for temporary right-of-entry or use of portions of the right-of-way shall not be issued without prior determination by the State Reclamation Board sufficiently in advance of issuance to permit adequate study and consideration and determination of conditions to be embodied in the permit document. Executed copies, in triplicate, of the permit document as issued shall be furnished the State Reclamation Board. See Exhibit G for sample permit of right-of-entry.

e. Permits for Improvements or Construction within the Project Right-of-Way. All requests for permits for construction of any improvements of any nature within the limits of the project right-of-way shall be referred to the District Engineer through the State Reclamation Board for determination that such construction will not adversely affect the stability, safety, and functioning of the protective facilities, and for definition of conditions under which permit should be granted. These conditions will include, among others, the following items:

(1) That all work shall be performed:

(a) In accordance with standard engineering practice and in accordance with plans and specifications approved by the District Engineer or his authorized representative; drawings or prints of proposed improvements or alterations to the existing flood control works must be submitted for approval to the State Reclamation Board sufficiently in advance of the proposed construction to permit adequate study and consideration of the work.

(b) To the satisfaction of the District Engineer.

(2) After completion of the work, "As Constructed" drawings or prints, in duplicate showing such improvements as finally constructed shall be furnished the District Engineer.

f. Coordination of Local Activities. In accordance with the provisions of Flood Control Regulations, paragraph 208.10(a)(9), the Superintendent will, during periods of flood flow, coordinate the functions of all agencies, both public and private, that are connected with the protective works. Arrangements shall be made with the local law enforcement agencies, street departments, and railroad and utility companies for developing a coordinated flood-fighting program; and an outlinecof this program shall be filed with the District Engineer.

g. Inspection.

(1) Flood Control Regulations, paragraph 208.10(b)(1), are quoted in part as follows:

American River Exhibit

"(b) Levees (1) Maintenance . . . Periodic inspections shall be made by the Superintendent to insure that . . . . maintenance measures are being effectively carried out . . . Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days and such intermediate times as may be necessary to insure the best possible care of the levee."

(2) For sake of uniformity, and to the extent practicable, the dates of inspection shall be as follows: 1 November, 1 May, and immediately following each flood flow in excess of a reading of 40.0 on U. S. Geological Survey station gage located on the H Street Bridge over the American River.

(3) The check lists and instructions shown in Exhibit E, Sheets 1 to 8, inclusive, are to be explicitly followed in each inspection to insure that no features of the protective system are overlooked. Check lists locally typed or printed in conformity with sheets 2, 4 and 6, shall have printed on the reverse side the applicable instructions shown on sheets 3, 5 and 8, Exhibit E. Carbon copy of the inspector's original field notes as recorded on the check list shall be transmitted to the District Engineer immediately following each inspection, and one copy included as an inclosure to the semi-annual report as provided in paragraph 3-07(i)(1) of this manual.

h. Maintenance.

(1) Flood Control Regulations, paragraph 208.10(b)(1) are quoted in part as follows:

"(b)(1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to . . . exterminate burrowing animals, and to provide for . . . . . removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces . . . Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

(2) Full responsibility for making the repairs and the methods used is placed on the Superintendent, but the experience and facilities of the District Engineer will be available to him for advice and consultation.

(3) All repairs shall be made in accordance with standard engineering practice, to line and grade and in accordance with details shown on the construction drawings for the project works, copies of which are included in Exhibit B. No change or alteration shall be made in any feature of the project works without prior determination by the District Engineer that such alteration will not adversely affect the stability and functioning of the protective facilities. Plans and specifications of all changes or alterations that may be proposed by the Superintendent shall be submitted to the District Engineer for investigation and approval before prosecution of the work.

i. Reports.

(1) Semi-Annual Report. In accordance with the provisions of the Flood Control Regulations, paragraph 208.10(a)(6), the Superintendent shall submit within a 10-day period following 1 December and 1 June of each year, a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works. This report will present a statement of:

(a) The physical conditions of the protective works as summarized from the logs of inspection.

(b) Flood behavior of the protective works, and flood-fighting activities during the period.

(c) Prosecutions for encroachment or trespass.

(d) Permits issued for right-of-way or use of right-of-way.

(e) Permits issued for improvements or construction within the project right-of-way.

(f) Maintenance measures taken; nature, date of construction, and date of removal of temporary repairs; date of permanent repairs.

(g) Fiscal statement of cost and maintenance and operation for the period.

A suggested form for submission of the semi-annual report is included as Exhibit D, Sheets 1 and 2.

SECTION IV

FEATURES OF THE PROJECT SUBJECT TO FLOOD CONTROL REGULATIONS

4-01. Project Works. Construction along the American River as covered by this manual, consists of a levee along the right bank, stone protection at various places, irrigation structures and drainage structures from Carmichael Bluffs downstream about 8.3 miles. For further details see drawings of Exhibit B. The levee has been designed for flood flows up to 115,000 cubic feet per second without danger of overflow to adjacent areas.

4-02. Levees.

a. Description. The levee described in this manual is located along the right bank of the American River from Carmichael Bluffs downstream about 8.3 miles. The levee has been built to adopted grade and section by new construction with a riverside berm of variable width (mostly in excess of 300 feet), riverside slope of 1 on 3, crown width of 20 feet and landside slope of 1 on 2. The patrol road surfacing consists of 4 inches of crushed mineral aggregate 12 feet in width. Access ramps and turnarounds are also surfaced. For more complete detail of items included in construction of the above-mentioned levee, refer to the "As Constructed" drawings of Exhibit B. Structures affecting levee maintenance are listed in Exhibit E. Regulations regarding levee inspection, maintenance and operation will be found in paragraphs 4-02b, 4-02c and 4-02d of this manual.

b. Inspection.

(1) Pertinent Requirements of the Code of Federal Regulations. Flood Control Regulations, paragraph 208.10 (b) (1), are quoted in part as follows:

"(b) Levees - (1) Maintenance . . . Periodic inspection shall be made by the Superintendent . . . to be certain that

(i) No unusual settlement, sloughing, or material loss of grade of levee cross section has taken place;

(ii) No caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds, during inappropriate seasons, which will retard or destroy the growth of sod; (see Note (a) at end of subparagraph (1).)

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee ..."

Note (a)

Since the growth of sod on the slopes of the levees of this project is not practicable and as the nature of the levee growth warrants burning thereof to facilitate inspection, the provisions of subparagraph b(1) of the regulations inconsistent therewith shall not apply. In place of item (vii), therefore, the following shall be observed:

> Weeds, grasses and debris on the levee shall be burned during appropriate seasons, where not dangerous or impracticable, in order to permit the detection of cracks, holes, burrows, slips, and other damage and to permit the detection and extermination of burrowing animals and that grass and weeds on levee slopes be mowed where removal by burning is dangerous or impracticable, such as on peat levees or where burning would constitute a hazard.

(2) To insure the taking of such maintenance measures as will be required for proper functioning of the levee, the following items shall be specifically covered in each inspection:

(a) Aggradation or degradation of the stream bed along the toe.

(b) Settlement of levee fill.

(c) Erosion of levee slopes; both sides of levees.

(d) Presence of seepage; saturated areas, or sand boils back of levee.

(e) Condition of access roads and roadway on levee.

c. Maintenance.

(1) Repairs to Levee Embankment. Methods used for repair or reconstruction of the levee fill will depend on the extent of the damaged section. If of small extent, the most suitable method will be to bring the levee back to line and grade by a fill made in 6-inch layers of earth free from brush, roots, sod or other unsuitable material.

If of larger extent, the fill should be made in the same manner as the original construction, of selected material from borrow pits approved for the project, placed in uniform layers of loose material and not more than 6 inches in depth and compacted in accordance with the specifications under which the work was completed or compacted according to approved construction practices, the Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the levees in time of flood.

(2) Depredations of Burrowing Animals. Dens and runways formed within the levee by burrowing animals are frequently the causes of levee failures during flood stages. Burrowing animals such as muskrats, ground hogs, ground squirrels, moles and gophers, found in the levee should be exterminated. The dens and runways should be opened up and thoroughly compacted as they are backfilled. Levees kept properly cleared are not seriously menaced by burrowing animals as they prefer areas where a protective cover, such as high grass, weeds, and brush, is found. Several methods of extermination are found effective, such as trapping, baiting, and poison gases, depending on the type of animal present and the time of year the work is done. Advice concerning the best methods in each locality can be obtained from the County Agricultural Agent.

(3) Access Roads. Access roads to the levees shall be maintained in such condition that they will be accessible at all times to trucks used to transport equipment and supplies for maintenance of flood fighting.

d. Operation.

(1) Pertinent Requirements of the Code of Federal Regulations, Flood Control Regulations, Par. 208.10 (b)(2) are quoted in part as follows:

"(2) Operation. During flood periods, the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope to be certain that:

"(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structures.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

(2) It shall be the duty of the Superintendent to maintain a periodic patrol of the project works during all periods of flood flow in excess of a reading of 40.0 on the U.S. Geological Survey gaging station located on the "H" Street Bridge over the American River, and to maintain a store of supplies and equipment available for emergency flood fighting operations and emergency repairs. In this connection, attention is invited to Section V of this manual for suggested methods of combating flood conditions. The Superintendent shall cause readings to be taken of the U.S.G.S. staff gage, or at a more accessible gage if properly correlated with stream discharge, at intervals of two to four hours during the time when the water surface is above flood stage, noting the time of observations. These readings shall be entered in the log of flood observations, one copy of which shall be forwarded to the District Engineer immediately following the recession of the flood, and one copy transmitted as an inclosure to the semi-annual report, as provided in paragraph 3-07(i)(1) of this manual.

4-03. Channels and Floodways.

a. Description. The channel of this project extends from Carmichael Bluffs downstream about 8.3 ~~feet~~ miles. The only channel improvement consisted of clearing shallow uniform borrow from the riverside

berm. Regulations regarding inspection, maintenance, and operation of channels and floodways will be found in paragraph 4-03b, c and d of this manual.

b. Inspection.

(1) Pertinent Requirements of the Code of Federal Regulations. Flood Control Regulations, Par. 208.10 (g) (1) are quoted in part as follows:

"(g) Channels and floodways . . . (1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections ...."

(2) The purpose of the flood-flow channels inspection is to insure that conditions which affect the channel capacity will remain the same, as far as

possible, as those considered in the design assumptions and that no new conditions develop that may affect the stability of the project structures. At each inspection required by Par. 208.10 (g)(1) of the Flood Control Regulations, particular attention will, therefore, be given the following:

(a) Location, extent and size of vegetal growth.

(b) Unauthorized operations within the flood-flow channel right-of-way, such as excavations, buildings, and other structures, levees, bank protection, or training dikes.

(c) Rubbish and industrial waste disposal.

(d) Changes in the channel bed such as aggradation or degradation, which would interfere with free-flow from side drainage structures or induce local meanders that would scour the banks.

(e) Operations of any nature upstream from the project that would affect flow conditions within the limits of the flood control project.

(f) Condition of project structure.

1. Channel walls;

a. Deviation from alignment and grade.

b. Development of cracks and spalls.

c. Mechanical injuries.

2. Fencing.

a. Injuries to posts, fencing or barbed wire.

b. Damage to galvanizing.

3. Earth fills:

a. Settlement.

b. Erosion of both slopes.

c. Excessive seepage or saturation area back of fills.

d. Condition of bank protection - concrete or stone blanket.

4. Right-of-way:

a. Presence of dumped refuse.

b. Encroachment or trespass.

(3) No excavation within the limits of this unit of the American River Project will be permitted unless an excavation permit has been approved by the State Reclamation Board.

(4) If any work is done to improve flow conditions in the American River, it should be coordinated with the District Engineer to insure that proper provisions are made for channel alignment and capacity to conform to the existing project.

(5) The intent of these inspections is to disclose all conditions which in any way affect the stability of the structures and their functioning for the control of floods. Each inspection report should note and comment on any repair measures that have been taken since the last inspection. In making these inspections, the check sheets included as Exhibit E shall be explicitly followed.

c. Maintenance.

(1) Pertinent Requirements of the Code of Federal Regulations. Flood Control Regulations, Par. 208.10 (g)(1) are quoted in part as follows: ".... Immediate steps will be taken to remedy any adverse conditions disclosed by such inspection ...."

(2) Shoaling or aggradation at the inlets or outlets of side drainage structures may render them inoperative. It is, therefore, imperative that all drains be kept open and unobstructed at all times.

(3) Dumped rock or other suitable types of protection should be placed at locations found by experience to be critical trouble points, with a view to stabilizing the channel alignment and preserving the general uniformity of the bank lines.

(4) Sediment and debris plugs or other obstructions should be removed from the channel to prevent any tendency for the flows to be deflected within the channel. The heavy material likely to accumulate in the new channel at the mouths of tributaries should be removed to keep the channel clear.

(5) The channel and right-of-way shall be kept reasonably clear of debris, refuse matter, or industrial wastes.

(6) Weeds and other vegetal growth in the channel shall be cut in advance of the flood season and together with all debris, removed from the channel.

(7) All eroded concrete shall be repaired as soon as any reinforcing steel is exposed or erosion approaches a depth of 4 inches. For this purpose, it is recommended that the repair be made by thoroughly cleaning the surface by sandblasting and building up the section with pneumatically placed Portland cement mortar. All evidence of settlement, uplift, or failure of concrete structures shall be referred to the State Engineer for analysis and remedial measures.

(8) All damage to fencing, whether resulting from accidental or willful injuries or from corrosion, shall be promptly repaired with new material in order to maintain satisfactory protection to the public.

d. Operation.

(1) Pertinent Requirements of the Code of Federal Regulations, Par. 208.10(g)(2) are quoted in part as follows:

"(g) Channels and floodways ....(2) Operation. Both banks of the channel shall be patrolled during periods of high water .... Appropriate measures shall be taken to prevent the formation of jams .... of debris. Large objects

which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter all snags and other debris shall be removed and all damage to …. walls, drainage outlets or other flood control structures repaired."

4-04. Drainage and Irrigation Structures.

a. Description. Drainage and irrigation structures which extend through the levees are listed as follows. **See drawing set 01-04-0415 for centerline stationing:**

Centerline Station	Bank	Size of Pipe	Other Structure Description	Elevation Invert of Pipe
33+55	Right	1-1/2"		60.6
37+58	"	1-1/2"		63.0
40+10	"	2-1/2"		-
42+25	"	1-1/2"		62.0
44+46	"	1-1/2"		63.0
48+75	"	1-1/2"		63.0
49+50	"	1-1/2"		63.7
51+50	"	1-1/2"		63.0
201+75	"	8"	Gate valve R.S. crown	55.0
203+45	"	3-24" C.	Pumping plant #2	40.0
203+45	"	24" C.	Pumping plant #2	30.0
224+30	"	10"		44.7
227+70	"	6"		43.4
288+65	"	8"	Gate valve R.S. crown	52.0
296+85	"	12"	Riser unit R.S. C.E.S.	40.0
346+09	"	12"	Riser unit R.S. C.E.S.	36.0
365+14	"	36"CM.	Riser unit R.S.	31.8
425+30	"	7-48"C.	Pumping plant No. 1	31.0
425+30	"	36"C.	Pumping plant No. 1	18.0
38°35.0514'N 121°25.2672'W (NAD 83)	**"**	**23'± Total Width**	**1-Double Box Culvert and 1-Single Box Culvert Endwall and Apron [R4]**	**4.45± DBC 4.73± SBC NGVD 1929**

Notes on abbreviations:

R.S. = Riverside
C.M. = Corrugated Metal
C. = Concrete
C.E.S. = Concrete Encased Steel Pipe
DBC = Double Box Culvert
SBC = Single Box Culvert

b. Inspection.

(1) Pertinent Requirements of the Code of Federal Regulations. Flood Control Regulations, paragraph 208.10 (d)(1), are quoted in part as follows:

"(d) Drainage Structures (1) Maintenance - Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled and trial operated at least once every 90 days ..... Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structures which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections."

(2) At each inspection required by paragraph 4-02(b)(2) of the Standard Manual, the following items, if applicable, shall be particularly noted:

(a) Debris or other obstructions to flow.

(b) Condition of pipes and gates.

(c) Damage or settlement of pipe.

(d) Condition of concrete-cracks, spalls, erosion.

c. <u>Maintenance</u>.

(1) All eroded concrete shall be repaired as soon as erosion reaches a depth of 4 inches or any reinforcing steel is exposed. For this purpose it is recommended that the repair be made by thoroughly cleaning the surface by sandblasting

and building up the concrete to its original section with pneumatically-placed Portland cement mortar. All evidences of settlement, uplift, or failure of concrete structures should be referred to the State Engineer for analysis and recommendation of remedial measures.

(2) If the inspection shows that the automatic drainage structures have been jammed in an open position by debris or other obstructions, they shall be thoroughly cleaned so that they swing freely to a true closure. If any parts of the gates have been damaged or broken, they shall be replaced by new parts.

(3) Compliance with the provisions prescribed above pertaining to drainage structures is essential for proper maintenance of the levee system covered by this manual. Levee failures caused by neglected drainage structures are of common occurrence; it is, therefore, of utmost importance that these structures always be kept in perfect working condition in accordance with the regulations.

(4) Care should be taken not to bury any of the side drainage inlets in the event that it becomes necessary to fill any of the low-lying pockets in back of the levee. Plans for the maintenance of drainage facilities at any such points should be submitted to the State Reclamation Board for approval before such work is started.

d. Operation.

(1) Pertinent Regulations of the Code of Federal Regulations. Flood Control Regulations, paragraph 208.10 (d)(2) are quoted in part as follows:

"(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and objects which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed..... All drainage structures in the levee shall be inspected frequently during floods to ascertain

whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse conditions."

(2) The outlets of side drainage structures inundate at relatively low river stages. They should, therefore, be inspected at the first sign of a rise in the river to make certain that the gates are not jammed in an open position and thus allow flood waters to enter behind the levee.

4-05. Miscellaneous Facilities.

a. Description. Miscellaneous structures or facilities which were constructed as a part of, or existed in conjunction with, the protective works, and which might affect their functioning, include the following:

(1) Bridges.

(a) A low water bridge crossing the American River at approximate centerline station 229+00. This bridge to be maintained by the owners at the adjacent rock plant.

(b) The H Street bridge crossing the American River at approximate centerline station 364+00. This bridge to be maintained by the County of Sacramento.

(2) Utility Relocations. Because of the nature of the construction of the levee by local interests, no records of any utility relocations are available.

(3) Hydrographic Facilities. A continuous water stage recorder and staff gage located on the H Street Bridge. This station to be maintained by the U.S. Geological Society and the State Department of Water Resources.

(4) Slurry Wall Facilities.

(a) Site R4: A reinforced concrete drainage channel outlet wall keyed into the slurry wall built under a previous contract, at approximate centerline station 422+70. The integrity of the structure/SCB (soil cement bentonite) cutoff wall interface is to be maintained by the Superintendent.

b. Inspection and Maintenance.

(1) Pertinent Requirements of the Code of Federal Regulations. Flood Control Regulations, paragraph 208.10 (h)(1) are quoted in part as follows:

"(h) Miscellaneous Facilities. (1) Maintenance.
Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendant and appropriate maintenance measures taken. Damaged or

unserviceable parts shall be replaced without delay….”

(2) Inspection of the miscellaneous facilities shall be made at the same time that the inspection of the other features of the project are made, and shall be reported on check list No. 3, sheet No. 4 of Exhibit E.

(4) The interest of the Corps of Engineers and the responsibility of the local interests in the existing highway and railroad bridges is confined to their effect on the safety and functioning of the flood control channel, but any conditions noted in the inspections that may affect them in any way should, as a matter of courtesy, be brought to the attention of the agencies maintaining and operating them. If the inspection of any miscellaneous structure, either existent or constructed in the future under permit, discloses any condition that indicates the probability of failure during periods of high water, the Superintendent shall address a letter to the owner of the structure, quoting this manual as authority and inviting attention to the conditions observed and requesting that immediate steps be taken to correct them. A copy of such letter shall be forwarded to the District Engineer for his information. A report of the action taken by the owner shall be submitted to the District Engineer to accompany the next semi-annual report. A suggested report form is included as EXHIBIT D of this manual.

(5) The purpose of maintenance work is to insure continuous satisfactory operation of equipment. It is, therefore, important in such work that all possible causes of future trouble be found and corrected. Particular attention should be given to minor weaknesses which may be given to minor weaknesses which may be an indication of future trouble.

(5) Site R4: Modification or repair work in the vicinity of the concrete liner where the SCB cutoff wall is located should include provisions to avoid damaging the SCB cutoff. Work that requires penetrating the cutoff wall would require special consideration to assure that the cutoff wall forms a continuous seepage barrier as originally designed.

Acceptable seepage barrier earth fill would have at least 30 percent fines (percent passing the No. 200 sieve) with liquid limit less than or equal to 45 and plasticity index of greater than 7 and less than 25. The controlled low strength material replacing the cutoff wall material should have a permeability similar to the cutoff wall with at least 1x10-6 cm/sec permeability at 28 days and a strength of at least 40 psi at 28 days. Any potential impact to the cutoff shall be coordinated with the Corps of Engineers, Sacramento District to develop mitigation measures or repair methods for the cutoff wall.

Any channel modifications or repairs impacting the impervious blanket that starts at the SCB cutoff and extends to the levee slope shall be restored to the original layer thickness, using the same soil material type. Any repair to the concrete lined channel that affects the geomembrane and that connects the

concrete liner edge to the impervious blanket shall be restored.

a. Operation.

(1) Requirements of the Code of Federal Regulations. Flood Control Regulations, paragraph 208.10(h)(2) is quoted as follows:

"(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefore."

SECTION V

SUGGESTED METHODS OF COMBATING FLOOD CONDITIONS

5-01. Methods Suggested. Most of the methods described herein have been developed during years of experience with the various problems that often come up during periods of high water, and they are not intended to restrict the Superintendent, or others concerned, to a rigid set of rules for every condition that may arise. The remarks are primarily concerned with the earthen portions of the levee system. If problems not covered by these suggestions arise, where the Superintendent is in doubt as to the procedure to be taken, he will be expected to consult the District Engineer, U. S. Engineer Office, Sacramento, California, and follow standard engineering practices in meeting the situation. It should be noted that it is much better to be over-prepared for a "flood fight" than to find at the last moment that preparations were incomplete or unsatisfactory. Confidence of the protected persons and firms is a valuable asset that should not be carelessly lost through inefficient operation of the protection system in time of emergency.

5-02. Earthen levees. An earthen levee is in danger whenever there is water against it. This danger is directly proportional to the height of the water, the duration of the flood stage, and the intensity of either the current or wave action. The danger is inversely proportional to the cross-sectional area of the levee, the levee's height, and the degree of maintenance. A well constructed levee of proper section should, if maintained and not overtopped, hold throughout any major flood. However, a serious accident may result in a break. Foundation troubles result in sand boils or a sinking levee, and the local use of unsatisfactory materials causes slides and sloughs. However, such threatened failures can be met if prompt action is taken and proper methods of treatment are used. Wave wash is to be expected whenever the levee is exposed to a wide stretch of open water and is serious if permitted to continue over a considerable length of time.

5-03. Premeditated Damage. The Superintendent should continually guard against premeditated damage to the levee. In the event of an extraordinary flood requiring a fight over long stretches of levee on both sides of the river, there is a natural temptation to relieve the strain by premeditated breaking of the opposite line.

5-04. Security. Personnel of the Corps of Engineers, whether military or civilian, are not vested with any civil police authority in the performance of their engineering duties, and they will not attempt to exercise any such authority. The responsibility for protecting flood control works against sabotage, acts of depredation, or other unlawful acts rests with the local interests through local and State Governmental agencies.

5-05. Inspection of Flood Control Works. Immediately upon receipt of information that a high water is imminent, the Superintendent should form a skeleton organization, capable of quick expansion, and assign individuals (Sector Foremen) to have charge of definite sections of levees. As his initial activity, each Sector Foreman should go over his entire sector and parts of adjacent sectors, making a detailed inspection, particularly with reference to the following matters:

a. Sector limits; ascertain that the dividing line between sectors is plainly determined and, if necessary, marked.

b. Condition of new levees and recent repairs.

c. Condition of culverts, flap gates, and sluice gates.

d. Transportation facilities; roads, rail and water communications.

e. Material supply; quantity, location, and condition.

f. Communications; locate and check all necessary telephones in the sector.

5-06. Preliminary Repair Work. After the initial inspection has been made, each Sector Foreman should recruit a labor crew and provide it with tools such as shovels, axes, wheelbarrows, etc. In addition, bulldozers, scrapers, trucks, etc., should be located and made ready for use in case of emergency. Then immediate action should be taken to perform the following work:

a. Fill up holes or washes in the levee crown, slopes, and landslide berms. Where new construction has been completed during the year, rain washes and deep gullies may have developed. While the levee is new, preparations should be made in advance to combat wave wash along the exposed reaches.

b. Repair gaps where road crossings have been worn down and the levee is below grade. In filling the road crossings, it may be necessary to obtain material from landside borrow pits, in which case excavation for the material should be kept at least 50 feet from the toe of levee. Any filling done in this connection should be tamped in place and, if in an exposed reach, subject to wave wash, the new section should be faced with bags of sand.

c. Repair and close all flap gates on culverts and see that they are seated properly before they are covered with flood waters.

d. Ascertain that all roads to and along the levee are in a good state of repair. The Superintendent should obtain assistance from the county road forces to have all roads put in first-class condition.

e. Locate necessary tools and materials (sacks, sandbags, brush, lumber, lights, etc.), and distribute and store the same at points where active maintenance is anticipated.

f. Check and obtain repair of all telephone lines necessary for operation, obtain lists of all team forces, motorboats, motor cars, and truck transportation that can be made available.

g. Make thorough arrangements with reliable citizens of the community for the supply transportation, subsistence, and shelter for the necessary labor.

h. Communicate directly with owners of all stock pastured on the levee and direct that all stock be removed from the levee right-of-way. Cut all fences crossing the levee that do not have gates provided.

i. Investigate all drainage ditches on the landside of the levee and open these drains when obstructions exist. Prepare to cut the necessary seep drainage ditches; however, no attempt should be made to drain the levee slope until actual seepage takes place.

j. Remove all dynamite and explosives of any kind from the vicinity of the levee.

5-07. Disaster Relief. It is the responsibility of local, state, municipal authorities, supported by and/or working in connection with the American Red Cross to adopt measures for the relief of flood disaster victims. Relief measures can be undertaken by the Department of the Army through its Army Area Commander under existing Army Regulations, but such measures will be undertaken only as a last resort, in extreme cases and under compelling circumstances where local resources are clearly inadequate to cope with the situation.

5-08. Flood Fight. After the above preliminary organization and precautions have been completed, the "flood fight" itself commences. The methods of combating various defects in the earthen levee described in the following paragraphs have been proved effective during many years of use by the War Department.

a. Drainage of slopes. This work can be done economically while awaiting developments and will serve to make the levees more efficient. Crews should be organized to cut seep drains at all places

on the levee and berm when seepage appears. The drains should be V-shaped, no deeper than necessary, and never more than 6" deep. Care must be taken not to cut the sod unnecessarily. In all instances, drains should be cut straight down the levee slope or nearly so. Near the toe of the slope the small drains should be Y'd together and led into larger drains, which, in general, should lead straight across the landside berm into the landside pits or nearest natural or artificial drain.

b. Sand boils. These danger spots are serious if discharging material. The common method of controlling sand boils consists of walling up a watertight sack ring around the boil up to a height necessary to reduce the velocity of flow to a point at which material is no longer discharged from the boil. See Exhibit "C" Plate 1. The sack ring around the boil should be large enough to protect the defective area immediately surrounding the boil. If several boils of sufficient force to displace sand are observed a sack sublevee may be built around the entire nest of boils, rising to such a height that none of the boils will discharge with enough force to displace sand.

c. Wave Wash. The Superintendent and Sector Foremen should study the levee beforehand to determine the possibility of wave wash. All such reaches will be located well in advance and for use in emergency, a reserve supply of filled sacks and rolls of cotton bagging will be kept on board flats. If the slope is well sodded, a storm of an hour's duration should cause very little damage. During periods of high wind and high water, ample labor should stand by and experienced personnel should observe where the washouts are beginning by sounding or by actually wading along the submerged slope. Sections of cotton bagging should be placed over the washed areas, as shown on Exhibit "C", Plate 3. As an alternative, filled sacks should be placed in the cut in an effective manner and as soon as possible. The filled sacks should be laid in sections of sufficient length to give protection well above the anticipated rise. Bagging so laid must be thoroughly weighted down to be effective. Plate 2, Exhibit "C" shows a movable type of wave wash protection, also used with good results. Its advantage is that it can rapidly be built at any convenient place and easily set in place on the job.

d. Scours. A careful observation should be made of the riverside of the levee at all localities where a current of more than two feet per second is observed, or where the profiles show a high water slope of two feet per mile or greater. Trouble may be looked for at the ends of old levee dikes, road-crossing ramps, old traverses, and places where pipes, sewers and other structures penetrate the levee. If any sign of scour is observed in the pits or at the ends of the dikes, soundings should be taken to observe

the amount and progress of the scour. The approved method of construction to check scour in the pits, on the slopes, or at the ends of dikes will be to construct deflection dikes using brush, treetops, or lumber, driving stakes and wiring together, and filling in between with brush and filled sacks or stone.

e. Caving bank protection. As protection against active caving of riverbanks, rock-filled cribs are very effective if properly placed. Cribs are usually 14 by 14 feet in plan by 10 to 14 inches in inside depth. The cribs are constructed on a double thickness of 1" x 4" x 14' lumber, equivalent to 2" x 4" pieces, lapped rail fence fashion at all corners and intersections. They are divided into four compartments of about equal area by two perpendicular cross walls constructed in the same manner as the side walls. The floors and covers are built up of double 1" x 4" boards spaced about 9" center-to center. Under the floor and perpendicular to the direction of the floor boards are five equally spaced pairs of 1" x 4" boards about 3 feet center-to center. On top of the cover, perpendicular to the direction of the cover boards, are three pairs of top boards, one over each of the side walls and one over the central division wall. All intersections are nailed with one 20d nail. The compartments are filled with rock before covering. Each wall intersection of the fabricated cribs is securely fastened by a loop of No. 9 wire. See Exhibit "C", Plate 4.

5-09. Topping. Immediate consideration should be given the grade line of each levee section by comparison of existing grades with those shown on the drawings, Exhibit "B". If any reaches show a grade below the previous highest water, emergency topping should be undertaken at once to such a grade as may be established by the District Engineer, U. S. Engineer Office, Sacramento, California, as follows:

a. Sack topping. Sack topping may be used to raise the crown of the levee about three feet. The sacks should be laid stretcherwise or along the levee for the first layer, crosswise for the second layer, and so on. Sacks should be lapped at least 1/3 either way and well mauled into place. When properly sacked and tamped, one sack will give about three to four inches of topping. If gravel is available, it should be used for the front facing so as to avoid washing out.

b. Lumber and sack topping. This is the most commonly used method of raising low reaches in emergencies. In putting on this topping, as well as other topping, a careful line of levels should be run and grade stakes set in advance. 2" x 4" x 6' stakes should then be driven on the riverside of the crown six feet apart, and 1" x 12" boards nailed to the landside of the stakes. This wall, backed with a single tier of sacks, will hold out at least one foot

of water. If a second foot is necessary, the layers of sacks will have to be increased in number and reinforced. The stakes should be driven three feet in the ground, and should project out three feet, thus providing, in extreme cases, a three-foot topping if properly braced behind with sacks and earth. In some instances, it may be practicable to back up the planking with tamped earth obtained in the vicinity in lieu of the sacks shown in the drawing, Exhibit "C", Plate 5.

5-10. Transportation. In instances where it is necessary to send equipment over roads that are impassable due to mud or sand, their passage may be provided by the use of a plank road or by means of steel or wire mats. Telephone communication should be provided along dangerous stretches of the levee when travel or other satisfactory means of communication cannot be maintained.

5-11. Use of Government Plant. The District Engineer is authorized to use or loan Government property and plant in cases of emergency where life is in danger and there is no opportunity to secure prior authority suitable private equipment is available, provided that such use is without detriment to the Government.

EXHIBIT A

FEDERAL FLOOD CONTROL REGULATIONS

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS

MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken; such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls.*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

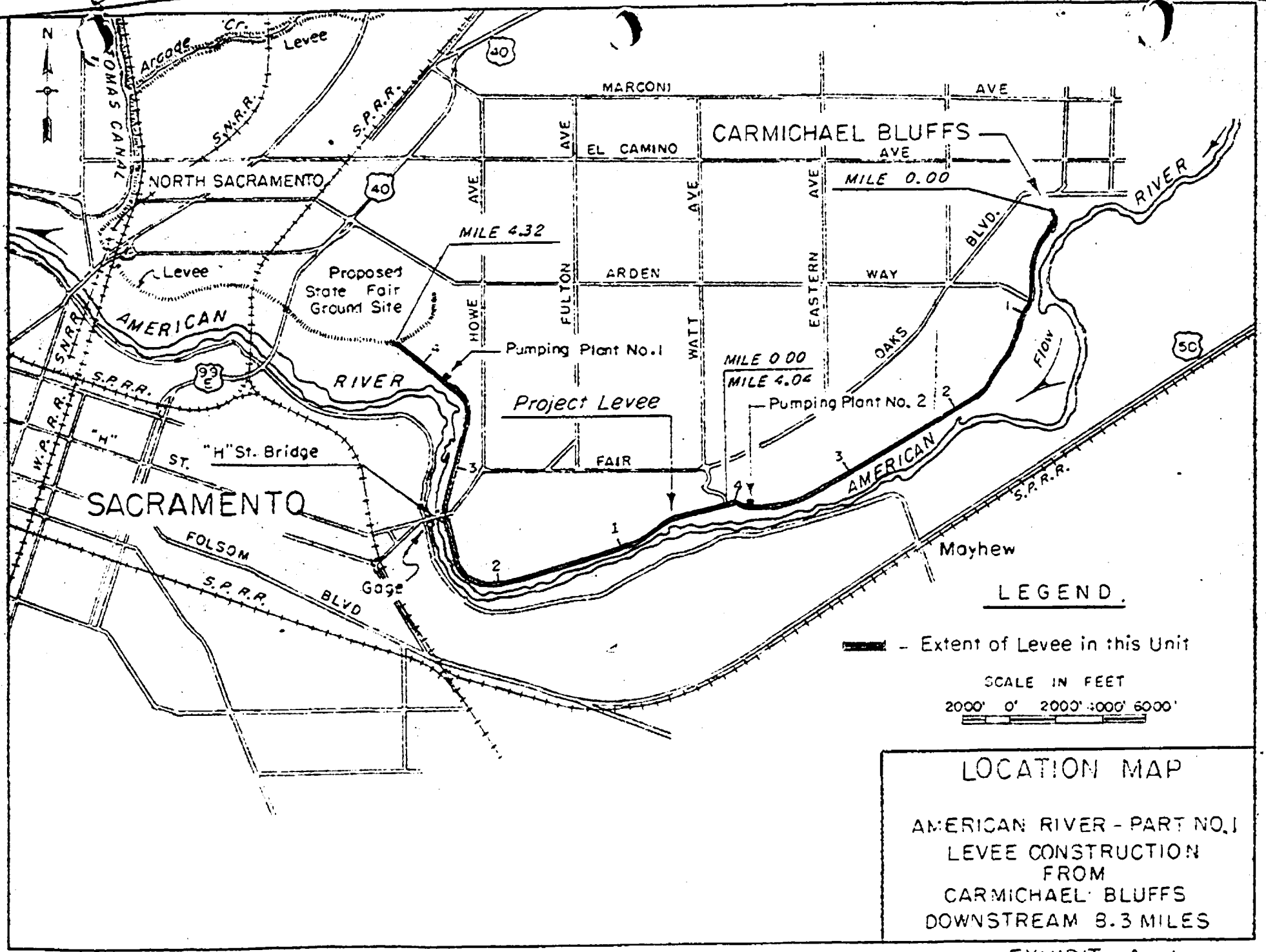
(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on



LOCATION MAP

AMERICAN RIVER - PART NO. 1
LEVEE CONSTRUCTION
FROM
CARMICHAEL BLUFFS
DOWNSTREAM 8.3 MILES

EXHIBIT A - 1

Exhibit B

"AS CONSTRUCTED"
DRAWINGS

(See Separate Folder for the Following Drawings)

FILE NO.	TITLE
1-4-375	Emergency Levee Repairs and Bank Protection North Levee American River 1.3 Miles above H Street Bridge, Sheets 1 to 3, inclusive.
1-4-415	Levee Construction and Bank Protection, Fair Grounds to Carmichael Bluffs, Sheets 1 to 20 inclusive.
1-04-0514	**American River Common Features (Remaining Sites) WRDA 1996 Contract 1, Sheets 1 to 21 inclusive. [Site R4]**

EXHIBIT B
Unattached

EXHIBIT C

PLATES OF SUGGESTED FLOOD FIGHTING METHODS

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* — (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

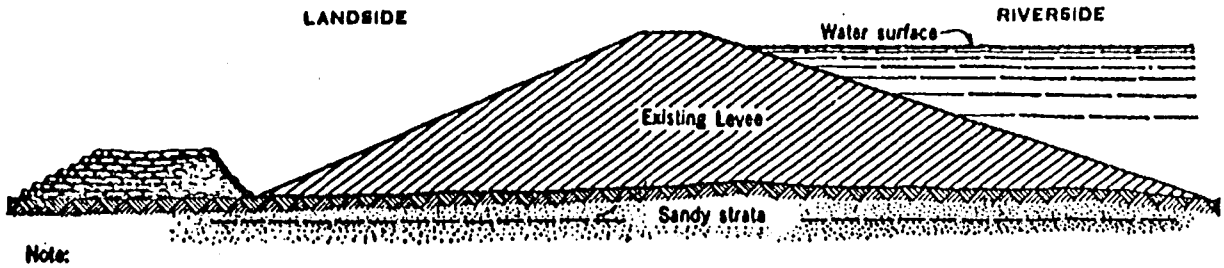
(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL] J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 44-12285; Filed, August 16, 1944; 9:44 a.m.]

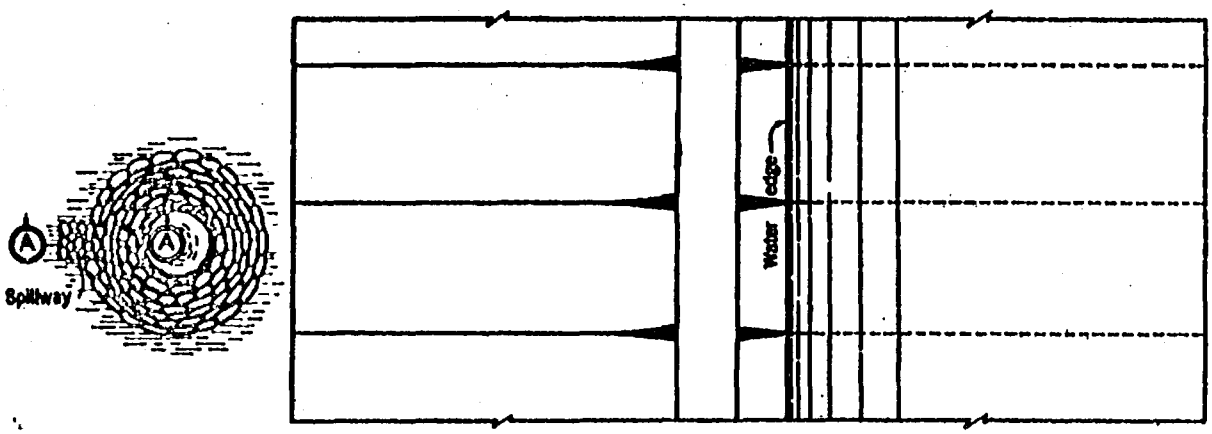
EXHIBIT "A" Sheet 2 of 2



Note:
Bottom width to be no less than 1½ times height.
Be sure to clear sand discharge.
Tie into levee if boil is near toe.

ELEVATION

SECTION A-A



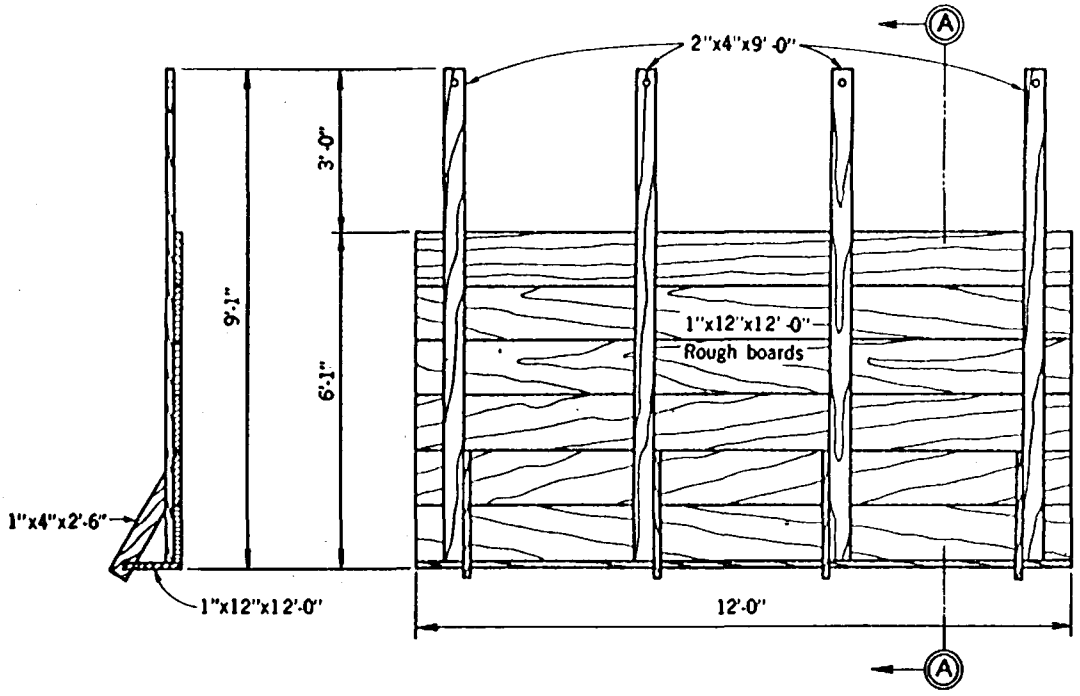
PLAN

Note:
Do not sack boil which does not put out material.
Height of sack loop or ring should be only sufficient to create enough head to slow down flow through boil so that no more material is displaced and boil runs clear.
Never attempt to completely stop flow through boil.

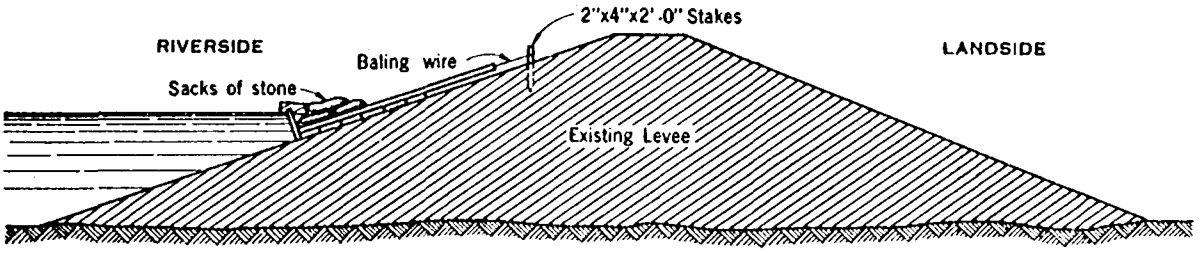
AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

CONTROL OF SAND BOILS

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.



SECTION A-A PLAN



SECTION

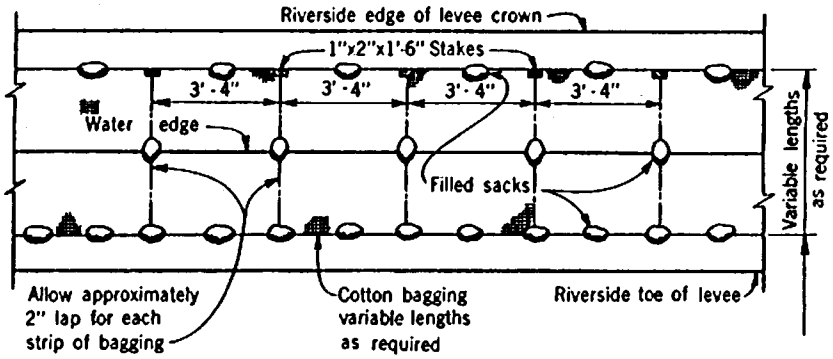
BILL OF MATERIAL FOR 100 FEET
LUMBER
56 pieces 1"x12"x12'-0" 32 pieces 1"x4"x2'-6" 32 pieces 2"x4"x9'-0" * 32 pieces 2"x4"x2'-0" * (Sharpened)
WIRE
200' baling wire
NAILS
4) lbs-8d nails

AMERICAN RIVER, CALIFORNIA

FLOOD CONTROL PROJECT

MOVABLE WAVE WASH PROTECTION

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.



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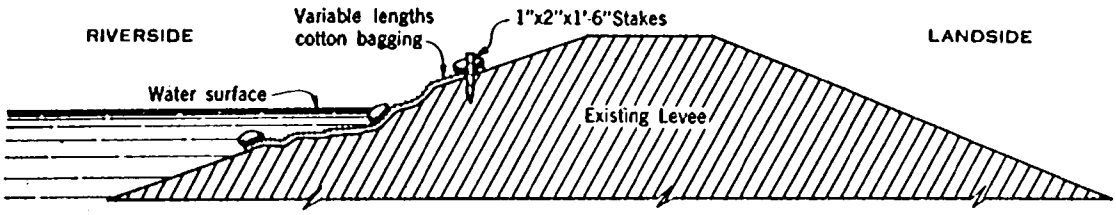


SECTION

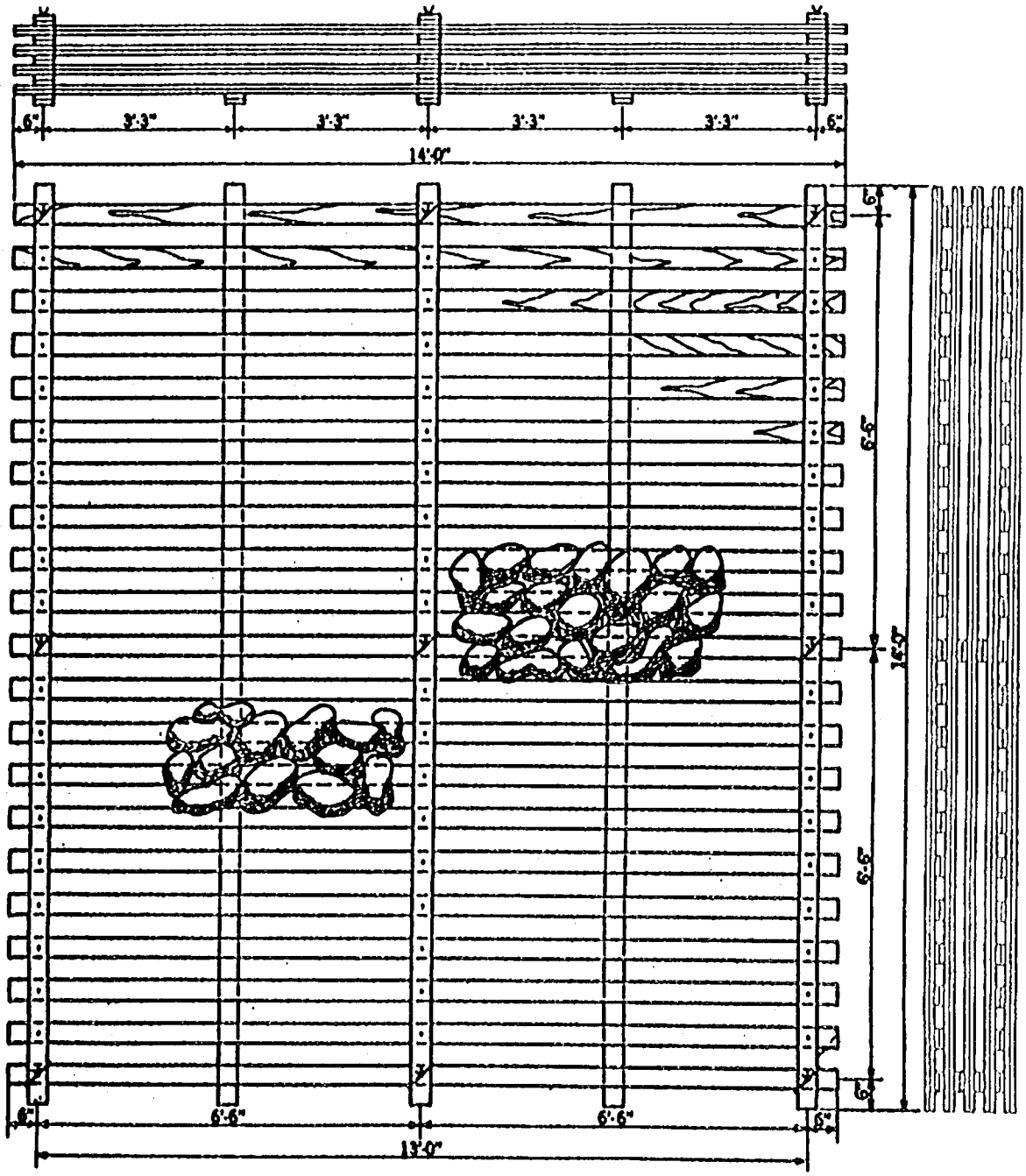
Note:
Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water surface. Where cotton bagging is not available burlap sacking may be substituted.

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE
LUMBER
* 30 Stakes 1"x2"x1'-6" * (Sharpened)
SANDBAGS
120 sand bags Cotton bagging as required

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

WAVE WASH PROTECTION

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.



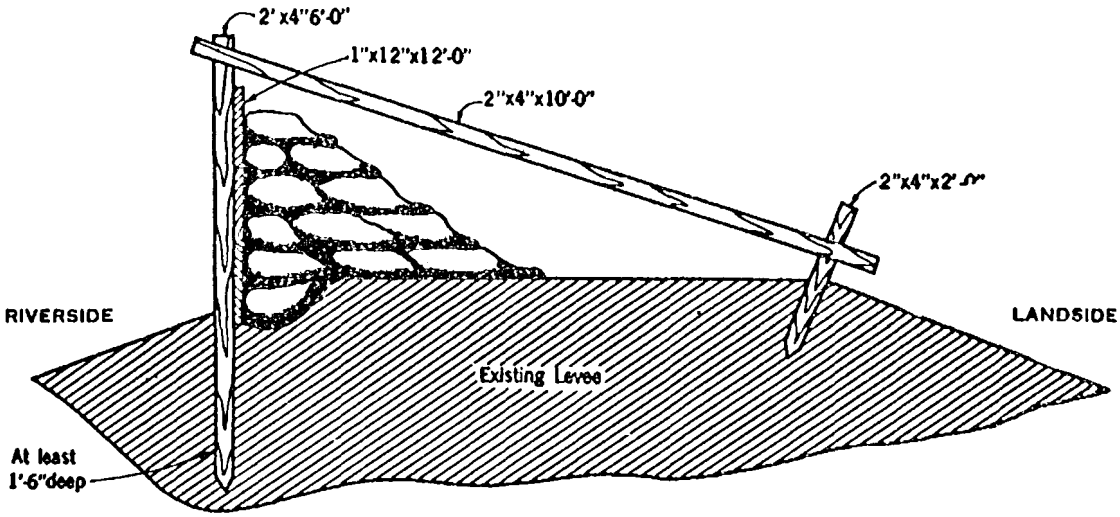
Note:
Cribs constructed of double thickness of 1"x4"x14'-0" lumber. Nail all intersections with 1-20d nail. Each intersection of walls securely fastened by a loop of No. 9 wire, tightly twisted.

BILL OF MATERIAL FOR ONE CRIB 13'-0"
LUMBER
130 pieces 1"x4"x14'-0"
WIRE
30' No. 9 wire
NAILS
12 lbs.-20d nails

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

CAVING BANK PROTECTION

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.



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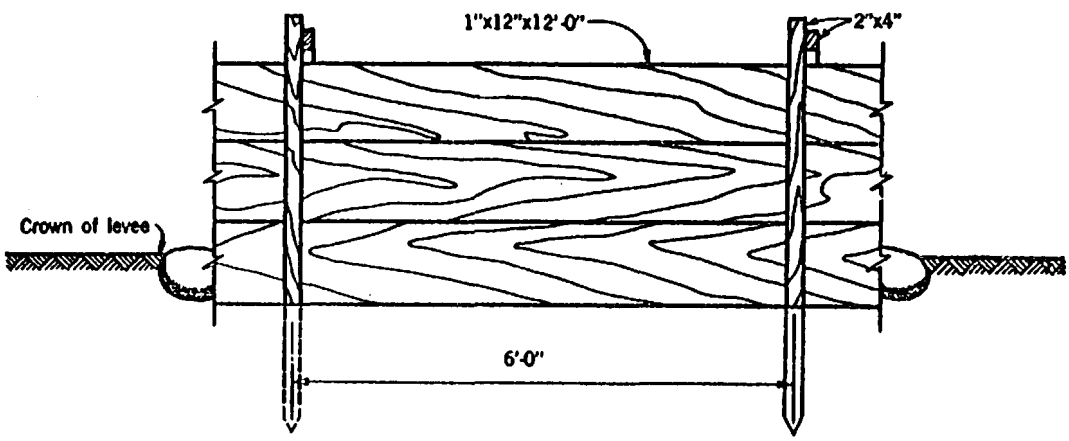


FRONT ELEVATION

BILL OF MATERIAL FOR 100 LINEAR FEET OF LEVEE
LUMBER
25 pieces 1"x12"x12'-0" 17 pieces 2"x4"x10'-0" * 17 pieces 2"x4"x6'-0" * 17 pieces 2"x4"x2'-0" * (Sharpened)
NAILS
1 lb. -8d nails 2 lbs.-16d nails
SANDBAGS
1100 bags

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

LUMBER AND SACK TOPPING

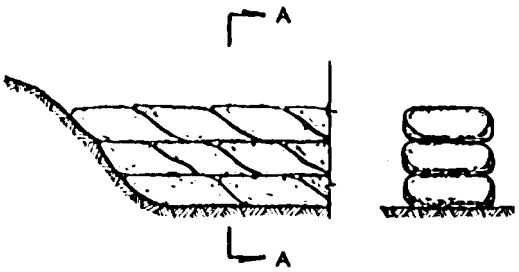
U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.

LEVEE CONSTRUCTION

SANDBAGGING USED TO PREVENT OVERTOPPING OF EXISTING LEVEES AND FOR RETAINING FLOOD WATERS WHERE NO BACK-UP MATERIAL IS AVAILABLE.

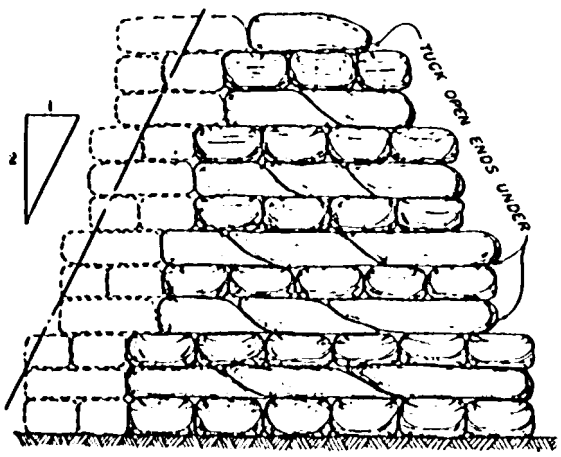
INSTRUCTIONS:

1. FILL SANDBAGS 1/2 TO 2/3 FULL BUT LEAVE ENOUGH FLAP TO TURN UNDER. DO NOT TIE. LEAVE ENDS OPEN.
2. FOR HEIGHTS OF 1 FOOT AND LESS, LAY 3 SINGLE COURSES WITH SACKS LENGTHWISE AS SHOWN IN SKETCH "A" BELOW.
3. FOR HEIGHTS GREATER THAN 1 FOOT, PLACE AS INDICATED IN SKETCH "B" BELOW.
4. WHEN BAGS ARE PLACED FLATTEN OUT AND FILL VOIDS BY WASHING BAGS WITH FEET AND VIGOROUSLY TRAMP EACH COURSE OF THE LEVEE SECTION. THIS IS AN EXTREMELY IMPORTANT OPERATION FOR PROVIDING A LEVEE WHICH WILL BE AS IMPERVIOUS TO WATER AS POSSIBLE AND TO INSURE STABILITY OF SECTION. LOOSELY PLACED SANDBAGS IMPROPERLY KEYED TOGETHER MAY RESULT IN FAILURE AND CAUSE SERIOUS DAMAGE.



ELEVATION SECTION A-A

SKETCH A



LEVEE SECTION

FOR HEIGHTS IN EXCESS OF THE ABOVE (APPROX. 3'-6") HOLD SAME BATTER AND BUILD ON THE SIDE AS INDICATED BY DASHED LINES ABOVE. ALTERNATE HEADER COURSES (BAGS PLACED CROSSWISE) AND STRETCHER COURSES (BAGS PLACED LENGTHWISE).

SKETCH B

ESTIMATING DATA:

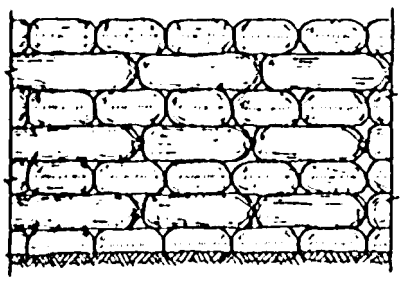
1. AVERAGE WEIGHT OF EACH FILLED SANDBAG, APPROX. 50 LBS.
2. APPROXIMATELY 1000 SANDBAGS ARE REQUIRED FOR EACH 100 SQ. FT. OF SURFACE (HEIGHT MULTIPLIED BY DISTANCE).

REVETMENTS

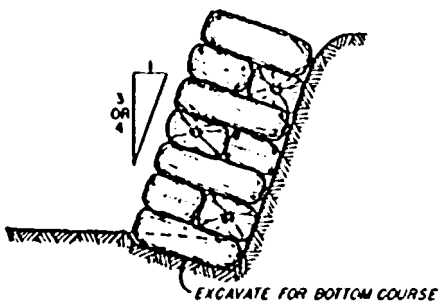
USED FOR EMERGENCY BANK PROTECTION TO PREVENT UNDER CUTTING AND CONTROL OF COURSE OF FLOOD CHANNELS.

INSTRUCTIONS:

1. FILL SANDBAGS 2/3 FULL AND TIE OPEN END.
2. TUCK IN BOTTOM CORNERS OF BAG AFTER FILLING.
3. PLACE BAGS PERPENDICULAR TO SLOPE.
4. LAY STRETCHER AND HEADER COURSES WITH CHOKE AND SIDE SEAMS IN: THUS:-



ELEVATION



SECTION

ESTIMATING DATA:

1. AVERAGE WEIGHT OF EACH FILLED SANDBAG APPROXIMATELY 65 LBS.
2. APPROXIMATELY 320 SANDBAGS ARE REQUIRED FOR EACH 100 SQ. FT. OF SURFACE TO BE REVETED.

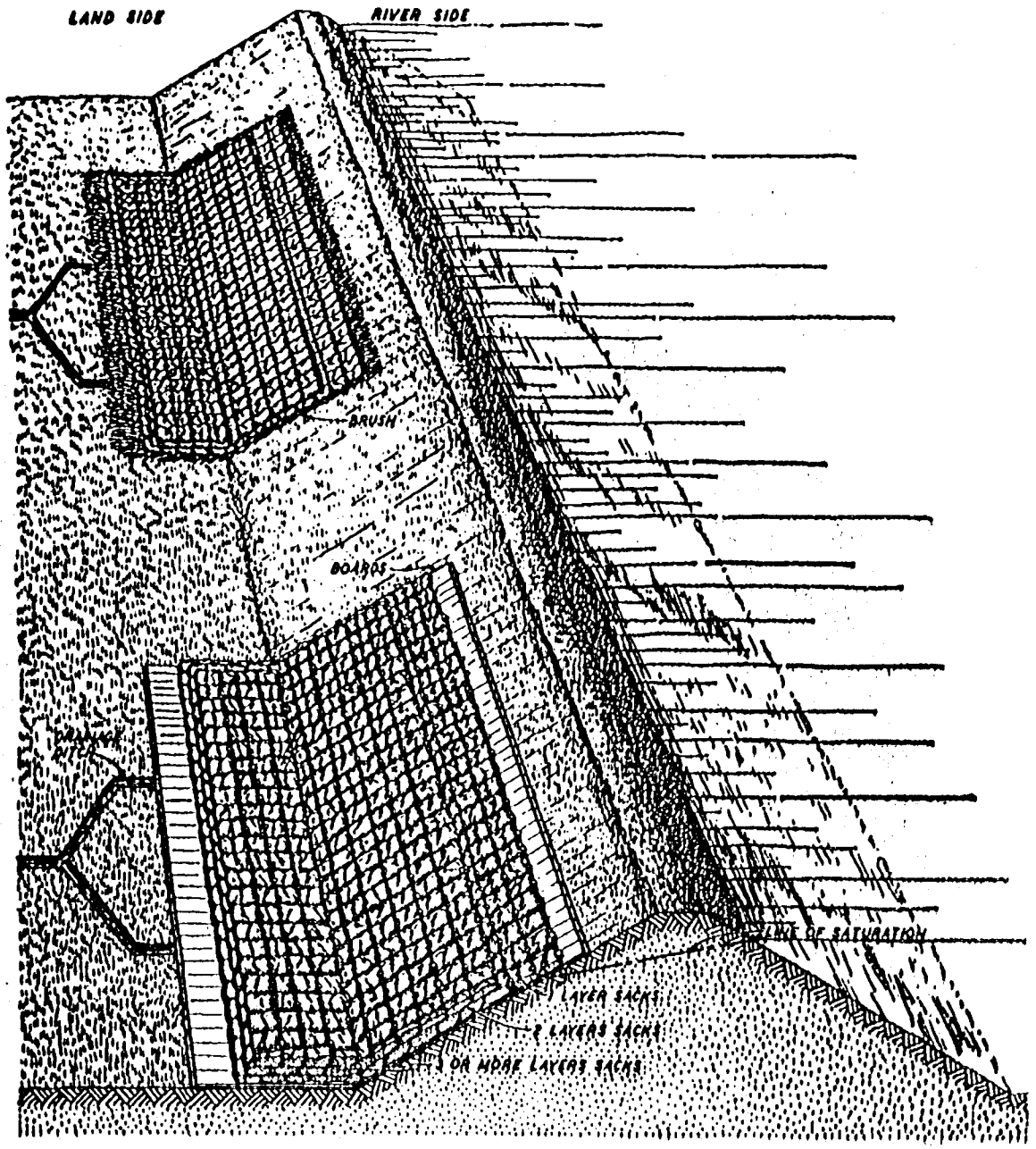
FILL MATERIAL:

THE IDEAL MATERIAL FOR FILLING SAND BAGS IS A FINE SAND OR COARSE SILT. AVOID, AS MUCH AS POSSIBLE, THE USE OF COARSE GRAVEL AND HEAVY CLAYS.

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

INSTRUCTIONS FOR PLACING SANDBAGS

U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.

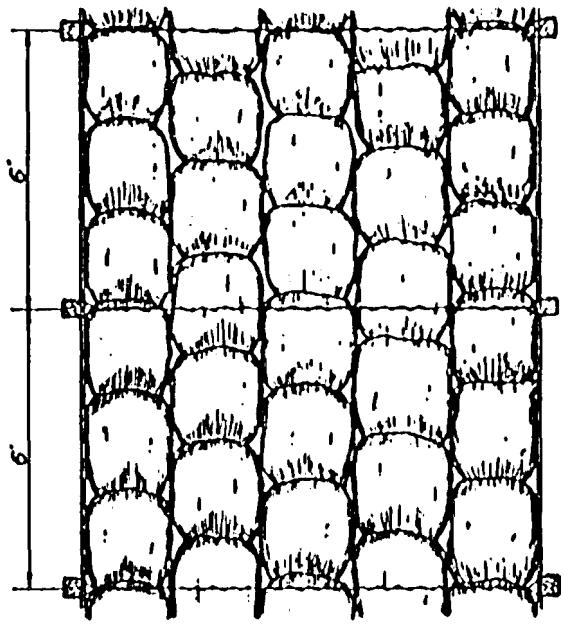


AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

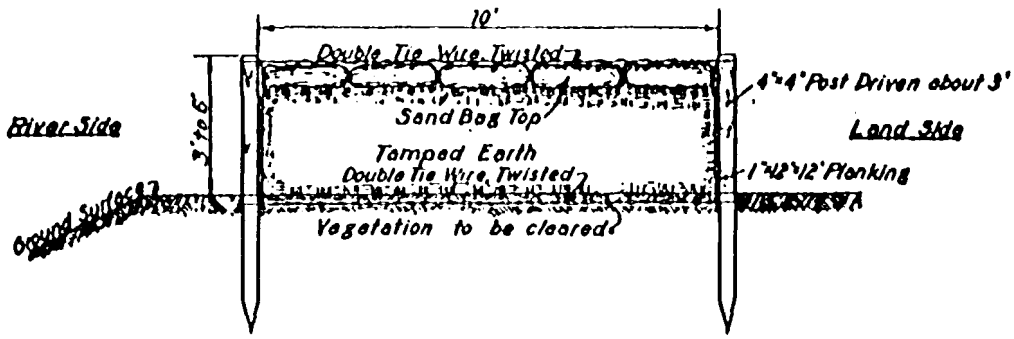
BRUSHING AND SACKING THE LANDSIDE SLOPE

U.S. CORPS OF ENGINEERS, SACRAMENTO, CALIF.

EXHIBIT O PLATE 7



PLAN



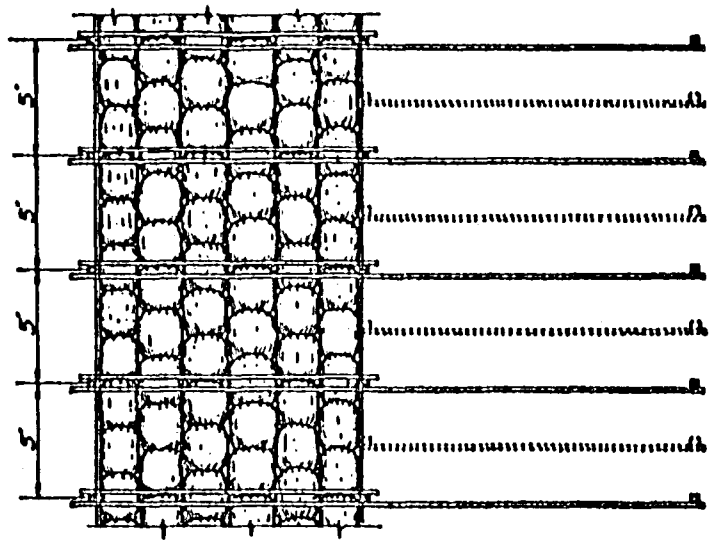
END ELEVATION

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE		
4 FT. HIGH	5 FT. HIGH	6 FT. HIGH
34 pieces 4"x4"x7' (sharpened) 1122 board feet 67 pieces 1"x12"x12' 25 lbs. wire #12 gage 13 lbs. 10d nails 600 sand bags 148 cu. yds. earth	34 pieces 4"x4"x8' (sharpened) 1371 board feet 84 pieces 1"x12"x12' 25 lbs. wire #12 gage 15 lbs. 10d nails 600 sand bags 185 cu. yds. earth	34 pieces 4"x4"x9' (sharpened) 1608 board feet 100 pieces 1"x12"x12' 25 lbs. wire #12 gage 17 lbs. 10d nails 600 sand bags 222 cu. yds. earth

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

3-6FT. MUD BOX LEVEE CONSTRUCTION DETAILS

U.S. CORPS OF ENGINEERS, SACRAMENTO, CALIF.



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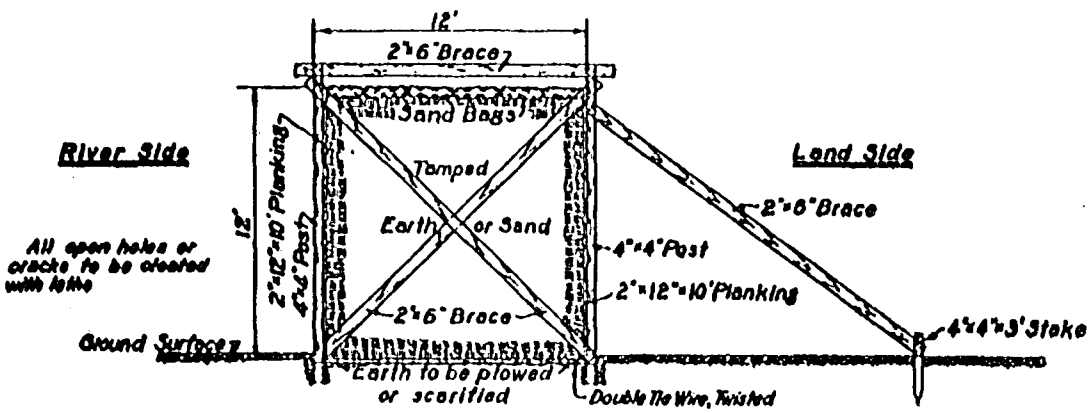


END ELEVATION

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE			
LUMBER	SAND BAGS	NAILS	EARTH or SAND
40 Posts 4"x4"x14' 240 Planks 2"x12"x10' 20 Braces 2"x6"x14' 60 Braces 2"x6"x10' * 20 Stakes 4"x4"x3' 5 bundles lathe	700	120 lbs-20d 4 lbs-3d fine WIRE 20 lbs-12 gage	534 cu yds.
Total Lumber 6987 board feet			

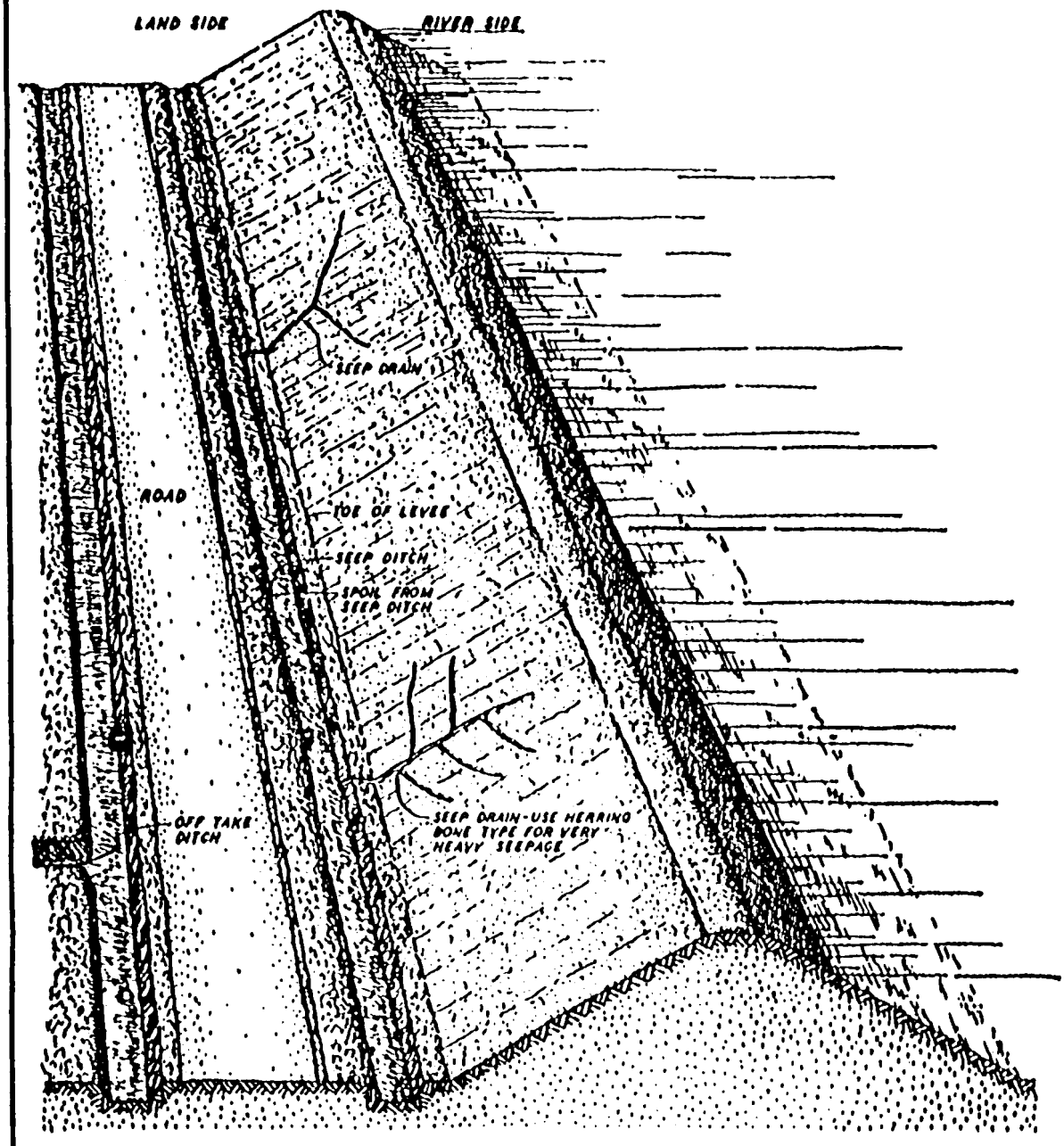
ADDITIONAL MATERIAL FOR BRACING BACK SIDE IN BETWEEN BENTS			
LUMBER	SAND BAGS	NAILS	EARTH or SAND
20 Posts 4"x4"x14' 20 Braces 2"x6"x10' * 20 Stakes 4"x4"x3'		6 lbs-20d	
Total Lumber 813 board feet			

* Sharpened

AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

MUD BOX BULKHEAD LEVEE CONSTRUCTION DETAILS

U.S. CORPS OF ENGINEERS, SACRAMENTO, CALIF.



AMERICAN RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

METHOD OF DRAINING LEVEE SLOPE

U.S. CORPS OF ENGINEERS, SACRAMENTO, CALIF.

EXHIBIT G PLATE 10

EXHIBIT D

SUGGESTED SEMI-ANNUAL REPORT FORM

TO: The District Engineer
Sacramento District
Corps of Engineers
1209-8th Street
Sacramento, California

(1 May 19__)
(1 Nov 19__)

Dear Sir:

The semi-annual report for the period (1 May 19__) to 31 October 19__) (1 November 19__ to 30 April 19__) American River Project levee, Sacramento County, is as follows:

a. The physical condition of the protective works is indicated by the inspector's report, copies of which are inclosed, and may be summarized as follows:

(Superintendent's summary of conditions)

It is our intention to perform the following maintenance work in order to repair or correct the conditions indicated:

(Outline the anticipated maintenance operations for the following 6 months.)

b. During this report period, major high water periods (water surface in the American River reached or exceeded the reading of 40.0 on U. S. Geological Survey Station gage located on the H Street Bridge) occurred on the following dates:

Dates	Maximum Elevation
_____	_____
_____	_____
_____	_____

EXHIBIT D
Sheet 1 of 2

Comments on the behavior of the protective works during such high water periods are as follows:

(Superintendent's log of flood observations)

During the high water stages when the water level reached a height of _____, on the gage or excess thereof (dates)_____, it was necessary to organize and carry out flood operations as follows:

(See Maintenance Manual_____.)

c. The inspections have indicated (no) or (the following) encroachments or trespasses upon the project right-of-way.

d. (No) (_____) permits have been issued for (the following) improvements or construction within the project right-of-way.

Executed copies of the permit documents issued are transmitted for your files.

e. The status of maintenance measures, indicated in the previous semi-annual report as being required or as suggested by the representatives of the District Engineer, is as follows:

(Statement of maintenance operations, item by item with percent completion.)

f. The fiscal statement of the Superintendent's operations for the current report period is as follows:

	Labor	Material	Equipment	Overhead	Total
1. Inspection					
2. Maintenance					
3. Flood fighting operations					
TOTAL					

Respectfully submitted,

_____
Superintendent of Works

EXHIBIT D
Sheet 2 of 2

EXHIBIT E

CHECK LISTS OF LEVEES, CHANNEL AND STRUCTURES

For definition of "flood" or "high water period" see paragraph 1-06 of this manual.

CHECK LIST NO. 2

AMERICAN RIVER PROJECT
LEVEE AND CHANNEL

Inspector's Report Sheet No. ____ Inspector _____

Date _____ Superintendent _____

Item	Remarks
(a) Location by Station	
(b) Settlement, sloughing, or loss of grade	
(c) Erosion of levee slopes	
(d) Condition of roadways, including ramps	
(e) Evidence of seepage	
(f) Condition of farm gates and fencing	
(g) Maintenance measures taken since last inspection	
(h) Comments	

INSTRUCTIONS FOR COMPLETING SHEET 2, EXHIBIT E
(To be printed on back of sheet 2)

Item (a) Indicate levee station of observance, obtained by pacing from nearest reference point; indicate right or left bank.

Item (b) If sufficient settlement of earthwork has taken place to be noticeable by visual observation, indicate amount of settlement in tenths of a foot. If sloughing has caused a change in slope of the embankment sections, determine the new slope. Note areas where erosion or gullying of the section has occurred.

Item (c) If sufficient erosion or gullying of back face of back toe of levee has taken place to be noticeable by visual inspection, indicate area affected and depth.

Item (d) Note any natural change in any section of roadway or ramps. Indicate any inadequacy in surface drainage system.

Item (e) Indicate any evidence of seepage through the embankment section.

Item (f) Indicate the serviceability of all farm gates across the embankments and roadway, and indicate if repainting is required.

Item (g) Indicate maintenance measures that have been performed since last inspection and their condition at the time of this inspection.

Item (h) Record opinion, if any, of contributory causes for conditions observed and also any observations not covered under other columns.

NOTE: One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's semi-annual report.

CHECK LIST NO. 3

CHANNEL AND RIGHT-OF-WAY
AMERICAN RIVER

Inspector's Report Sheet No. ____ Inspector _____

Date _____ Superintendent _____

Item	Remarks
(a) Name of channel and location by stations	
(b) Vegetal growth in channel	
(c) Debris and refuse in channel	
(d) New construction within right-of-way	
(e) Extent of aggradation or degradation	
(f) Condition of riprapped section	
(g) Condition of bridges	
(h) Measures taken since last inspection	
(i) Comments	

INSTRUCTIONS FOR COMPLETING SHEET 4, EXHIBIT E
(To be printed on back of Sheet 4)

Item (a) Indicate station of observation obtained by pacing from nearest reference point.

Item (b) Note nature, extent, and size of vegetal growth within the limits of flood flow channel.

Item (c) Note nature and extent of debris and refuse that might cause clogging of the conduits of the irrigation intake works, fouling of the tainter gates, or the bridges over the channel.

Item (d) Report any construction along the diversion channel or above the diversion channel or above the diversion works that has come to the attention of the inspector and that might affect the functioning of the project.

Item (e) Indicate any change in grade or alignment of the channels, either by deposition of sediment or scour, that is noticeable by visual inspection. Estimate amount and extent.

Item (f) Indicate any change that has taken place in the riprap such as disintegration of the rock, erosion, or movement of the rock. Note the presence of vegetal growth through the riprap.

Item (g) Note any damage or settlement of the footings of the bridges. Indicate condition of wooden structures and if repainting is required. Indicate condition of bridge approaches, headwalls, and other appurtenances.

Item (h) Indicate maintenance measures that have been performed since the last inspection and their condition at time of this inspection.

Item (i) Record opinion, if any, of contributory causes for conditions observed, also any observations not covered under other columns.

NOTE: One copy of the Inspector's Repot is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's semi-annual report.

CHECK LIST NO. 4

DRAINAGE AND IRRIGATION STRUCTURES
AMERICAN RIVER PROJECT

Inspector's Report Sheet No. ____ Inspector _____

Date _____ Superintendent _____

See drawings of Exhibit B for location of stations

(a) Centerline Station	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of-way adjacent to structure	(g) Repair measures taken since last inspection	(h) Comments
33+55	Right						
37+58	"						
40+10	"						
42+25	"						
44+46	"						
48+75	"						
49+50	"						
51+50	"						
201+75	"						
203+45	"						
203+45	"						
224+30	"						
227+70	"						

CHECK LIST NO. 4 (Cont'd)

DRAINAGE AND IRRIGATION STRUCTURES
AMERICAN RIVER PROJECT

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendent _____

See drawings of Exhibit B for location of stations

(a) Centerline Station	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of-way adjacent to structure	(g) Repair Measures Taken since last Inspection	(h) Comments
288+65	Right						
296+85	"						
346+09	"						
365+14	"						
425+30	"						
425+30	"						

INSTRUCTIONS FOR COMPLETING SHEETS 6 AND 7, EXHIBIT E
(To be printed on back of Sheets 6 and 7)

(1) Enter station of all structures under Column (a) for check list.

(2) Inspect inlet, barrel, and outlet for accumulation of sediment, rubbish, and vegetal matter. Note condition under Column (c).

(3) If any settlement or damage to the pipe, barrel, or invert of the drain has occurred, estimate the location and amount. Note particularly if any backfill has come into the pipe or been disturbed. Record observations under Column (d).

(4) Inspect the concrete portions of the structures for evidence of settlement, cracks, "pop-outs", spaces, abrasive wear, or other deterioration. Record conditions under Column (e).

(5) Inspect backfill area adjacent to structure for evidence of erosion caused by overflow of the drainage structure and note conditions in Column (f).

(6) Under Column (g) indicate physical measures that have been taken to correct conditions reported in last inspection, and their condition at time of this inspection.

(7) Under Column (h) record opinion, if any, of contributory causes for conditions observed, also any observations not covered under other columns.

(8) A copy of the inspector's report is to be mailed to the District Engineer immediately on completion, and a record copy shall be attached to the Superintendent's semi-annual report.

EXHIBIT F

LETTER OF ACCEPTANCE BY STATE RECLAMATION BOARD

DEPARTMENT OF THE ARMY
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

REPLY TO
ATTENTION OF

Flood Protection and Navigation Section

JUL 0 1 2010

Mr. Jay Punia, Executive Officer
Central Valley Flood Protection Board
3310 El Camino Avenue, Room 151
Sacramento, California 95821

Dear Mr. Punia:

This letter is to transfer the U.S. Army Corps of Engineers (Corps) recently completed portion of work (R4) performed under the authority of the Water Resources Development Act of 1996 (WRDA 96). American River (Common Features) as authorized by WRDA 96 consists of lower American River levee strengthening of 8.9 miles of the right (north) bank and 10.6 miles of the left (south) bank levees, and 12.1 miles of Sacramento River east levee and berm raising. Eighteen American River "windows" exist where construction of separate cutoff walls and appurtenant structures around bridge abutments, deep underground utility lines and under low overhead utility lines for both right and left bank levees are required to ensure complete closure of the slurry wall. These "windows" are designated with either an "L" for left bank and "R" for right bank. The subsequent number designates its ordered position relative to the other similar project locations. This turnover letter is for site R4 only.

Site R4 is located approximately 250-feet south the Strong Ranch Pump Station and 1,330-feet northwest of the Northrop Avenue west end terminus as measured along the American River Bike Trail. The R4 project includes a new reinforced concrete drainage channel outlet wall keyed into the slurry wall built under a previous contract.

The construction was completed in accordance with American River Common Features WRDA 1996 – Remaining Sites Contract 1, Specification Number 1593, Design File Number 1-04-0514, Contract Number W91238-09-D-0020. As constructed drawings and revisions to the Operation and Maintenance Manual are enclosed. Also, a copy of the "Written Notice of Acceptance of Completed Work" is included as required by the Project Cooperation Agreement (PCA). Both hard-copy and electronic versions (CD) are provided.

This work meets the requirements of the existing Operation and Maintenance Manual American River - Part No. 1, Levee Construction from Carmichael Bluffs Downstream 8.3 miles; therefore, said flood control work is transferred as of the date of this letter to the State of California for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R). This letter of acceptance into the Federal flood control system should not be construed as an endorsement for inclusion into the National Flood Insurance Program as outlined in Title 44 of the Code of Federal Regulations Section 65.10 of the National Flood Insurance Regulations (44 CFR Section 65.10).

If you have any questions regarding this project, please contact the Project Manager, Mr. John Hoge, at (916) 557-53042. If you have any questions regarding this transfer, please contact Mr. Ryan Larson at (916) 557-7568, Flood Protection and Navigation Section. A copy of this letter is being furnished to Mr. Stein Buer, Sacramento Area Flood Control Agency, 1007 7th Street, Sacramento, CA 95814.

Sincerely,

Thomas C. Chapman, P.E.
Colonel, Corps of Engineers
District Engineer

Enclosures

WBH

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

17 NOV 1958

SPKKO-P 824.3 (Am Riv. MCP)

The Reclamation Board
State of California
1215 "O" Street
Sacramento 14, California

Gentlemen:

Reference is made to District Engineer's letter dated 2 June 1958, suggesting a joint inspection of certain levee units, stone protection and facilities pertaining to the American River Flood Control Project for the purpose of transferring them to the jurisdiction of the State of California for operation and maintenance. Reference is also made to the joint inspection of these levee sections and facilities made on 6 June 1958.

The required work consisting of construction of the levee units, stone protection and facilities referred to above was completed on 7 November 1958 in accordance with Specification No. 2287, Contract No. DA-04-167-CIVENG-57-136 and Drawing Nos. 1-4-415 and 1-4-432.

The work referred to above consisted of the following units:

1. Levee Construction - Right bank of American River from Station ℄ 19+30 to Station ℄ 212+20 and Station ℄ 229+30 to Station ℄ 456+31.35. The unit from Station ℄ 212+20 to Station ℄ 229+30 meets with the requirements of the American River Flood Control Project, therefore no work was necessary on this unit.

2. Stone Protection - Left bank of American River from Station ℄ -1+00 to Station ℄ 64+00.

3. Pumping Plants - Pumping Plant No. 1 & Pumping Plant No. 2.

The units described above now meet the requirements of the American River Flood Control Project, therefore in accordance with the assurance agreement dated 3 October 1956 the said units together with the waterway banks contiguous thereto are hereby transferred to the State of California for operation and maintenance.

OPERATIONS BRANCH

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

American River
Part no 1 + 2
Exhibit F

WBH:pnp

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

17 NOV 1950

SPKCO-P 824.3 (Am.Riv. FCP)
The Reclamation Board

The maintenance work required under the provisions of the Sacramento River Flood Control Project shall be performed in accordance with existing Flood Control Regulations, inclosed herewith, which have been prescribed by the Secretary of the Army pursuant to Section 3 of the Act of Congress, approved 22 June 1936, as amended and supplemented. As provided under Paragraph 208.10(10) of these regulations, Operation and Maintenance Manuals covering these units of work are in the process of preparation and will be furnished to you upon completion.

A copy of this letter is being transmitted to the Department of Water Resources.

Sincerely yours,

1 Incl
F.C. Reg.

A. E. McCOLLAM
Colonel, CE
District Engineer

Copy furnished:
Dept Water Resources
23rd & N Sts
Sacramento, Calif w/o incl

OCE w/o incl
SoPacDivEngr w/o incl

cc: Engr Div w/o incl
Northern Area Ofc w/o incl
Opers Branch w/o incl

American River
Part No. 1 + 2
Exhibit F

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

C O P Y

C O P Y

December 19, 1958

District Engineer
Sacramento District
U. S. Corps of Engineers
P. O. Box 1739
Sacramento 8, California

Gentlemen:

Reference is made to your letter of November 17, 1958, file number SPKKO-P 824.3 (Am. Riv. FCP), regarding the responsibility for operation and maintenance of the section of levee and contiguous banks, stone protection and pumping plants, located along the right bank of the American River from Station 19+30 to Station 212+20 and from Station 229+30 to Station 456+31.35 and pumping plants #1 and #2; as well as pertinent facilities located along the left bank of the American River from Station 1+00 to Station 64+00.

The Reclamation Board at its meeting of November 20, 1958, formally accepted the maintenance responsibility of the above described area described in the first page of your letter under the conditions outlined in your letter.

Yours, very truly,

THE RECLAMATION BOARD
A. M. BARTON
Chief Engineer and General Manager

/s/ By William A. Carver
WILLIAM A. CARVER
Assistant Secretary

WAC;lb

EXHIBIT F
Sheet 1 of 3

C O P Y

C O P Y

January 21, 1959

District Engineer
Sacramento District
U. S. Corps of Engineers
P. O. Box 1739
Sacramento 8, California

Gentlemen:

Reference is made to your letter dated November 17, 1959, regarding the joint inspection of certain levee units, stone protection and facilities pertaining to the American River Flood Control project and the transfer of certain portions thereof to the State of California for operation and maintenance. Further reference is made to the fact that on January 7, 1959 this office received a telephonic communication from William Hargraves of your office regarding paragraph three, which is as follows:

> "1. Levee Construction - Right bank of American River from Station ℄ 19+30 to Station ℄ 212+20 and Station ℄ 229+30 to Station ℄ 456+31.35".

Information was also received to the effect that the following sentence:

> "The unit from Station ℄ 212+20 to Station ℄ 229+30 meets with the requirements of the American River Flood Control Project, therefore no work was necessary on this unit."

was somewhat misleading and was not intended to convey the information that this stretch between the above stations was to be excluded from the transfer to the jurisdiction of the State of California for operation and maintenance. This office was instructed that this transfer, above described, was included in the transfer to the State for operation and maintenance.

Therefore, this letter is forwarded to your office for the purpose of amending our letter to you dated December 18, 1958 and the first sentence of said letter should include Station ℄ 212+20 to Station ℄ 229+30 for the purpose of transfer to the State.

C O P Y

C O P Y

District Engineer

The Reclamation Board at its meeting of November 20, 1958 formally accepted the maintenance and operation of the above described area and the acceptance on the part of the Board included the area described in the first page of your letter and under the conditions outlined therein. Our letter informing you of the formal acceptance of the maintenance responsibility is hereby amended to the extent and as above indicated.

Yours very truly,

THE RECLAMATION BOARD
A. M. BARTON
Chief Engineer and General Manager

/s/ By William A. Carver
Assitant Secretary

WAC:lb

EXHIBIT
PERMIT

_____,
(Name of Levee Commission or City)

_____
(Location)

Permission is hereby granted to:

_____ _____
(Name of Firm or Individual) (Address)

TO: (Describe in these spaces the proposal, including kind and type of construction, purpose intended, location by stationing. Indicate passageway provided by means of gates, etc. Use separate sheets if necessary, identifying each by reference herein.)

_____

_____

_____

_____

Provided That:

Upon termination or expiration of this permit (whether by voluntary relinquishment by the grantee, by revocation by the grantor or otherwise) the grantee shall remove all structures, improvements, or appurtenances which may have been erected or constructed under this permit, and shall repair or replace any portion of the flood protection structure or right-of-way which may have been damaged by his operations (including grading and seeding, or sodding, if necessary), to the satisfaction of the grantor.

The structure or operation for which this permit is issued shall be maintained by the grantee in such manner as shall not injure or damage the flood protection structure, or interfere with its operation and maintenance in accordance with regulations of the Secretary of the Army.

The structure or operation covered by this permit may be damaged, removed or destroyed by the grantor in time of flood emergency if such action is determined by the grantor to be necessary in order to preserve life or property or prevent damage or impairment to the use or safety of the flood protection structure, and the grantor shall not be liable to the grantee for such damage or destruction.

Unless otherwise specifically provided herein, this permit may be cancelled at any time by the grantor upon 10 days written notice mailed to the address shown above. During such 10 day period, (or such other period as may be provided herein), the grantee will be permitted to remove any property or improvements installed under this permit, and to repair or replace any damage to the flood protection right-of-way or structures resulting from his use or operations. At the end of such period, the grantor shall have the right to possess and dispose of any such property or improvements remaining upon its right-of-way, and may proceed to repair or replace any such damage, and the grantee herein shall be liable to the grantor for the full cost of such repairs or replacements.

The construction, installation and maintenance of the structure or structures covered by this permit shall be subject to inspection by representatives of the grantor and the United States at all reasonable times.

In the event the work covered by this permit consists of or includes major construction, the cost of inspection thereof by the grantor and/or the United States shall be paid by the applicant.

Grantee agrees that it will not use the area or facilities covered by this permit, or permit such area to be used, for any purpose other than is specifically covered by this permit.

(Use these spaces for special conditions applicable to this permit.)

_____

_____

THIS PERMIT SHALL NOT BE VALID UNTIL APPROVED BY THE DISTRICT ENGINEER, CORPS OF ENGINEERS, U. S. ARMY, OR HIS AUTHORIZED REPRESENTATIVE.

Signature(Grantor) (Title) (Date)

Terms of this permit are hereby accepted

Approved:

Signature (Grantee) (Date) (Date)

District Engineer

REGULATIONS GOVERNING ISSUANCE OF PERMITS FOR USE OF RIGHTS-OF-WAY FOR FLOOD PROTECTION PROJECTS

As the flood protection works and rights-of-way are owned by the Local Interests and will be operated and maintained by them in accordance with the Regulations of the Secretary of the Army, and issuance of any permits to use any part of the rights-of-way will be handled by the Local Interests, with the restriction that no such permit may be issued without the approval of the District Engineer, as stated in paragraph No. 208.10, (a) General, (5) of the Regulations, a copy of which is attached hereto.

Applications for use of the rights-of-way should be addressed to The City or Levee Commission having jurisdiction over the local flood protection project. The City or Levee Commission will then forward the application to the District Engineer, Corps of Engineers, Sacramento, California, with its recommendation, with reasons for such recommendation. It is suggested that the application and recommendations be forwarded with a draft copy of the permit, in order that all objectionable features may be eliminated prior to its proffer to the applicant as this may prevent misunderstandings and arguments. If for any reason it is desired to forward the permit itself without this intervening step, five copies of the proposed permit should be included on which is stated the exact use of the rights-of-way, for which permission is being requested, together with any condition or restriction of the permit. The permit should be signed by the applicant and an official of the Local Interests. A drawing, sketch or detail plans as may be required to show the exact location, nature of work and proposed method of construction should be attached to each copy of permit. If the permit is approved by the District Engineer, three copies will be returned. This will enable each party concerned to have a copy of the approved permit.

In any case where a permit is requested for any purpose which might cause disfigurement or damage to the flood protection rights-of-way or structure in its erection, use, or removal, it is suggested that the applicant be required to post a bond of sufficient amount to protect the Local Interests from any cost of repair or removal, and to guarantee faithful performance of the permit conditions. In such cases the permit should state the amount and conditions of the bond.

In cases involving major construction or other work which may directly affect the flood protection structure, it will be necessary that the United States inspect the work and the Local Interests may also desire to inspect it. As stated in the permit form, such inspection will be at the expense of the grantee, and this should be called to his attention. Except in cases of known financial security, arrangements should be made with the grantee for an advance deposit or bond to cover such costs.

There is attached hereto a copy of a permit form which has been successfully used by a number of cities and levee committees.