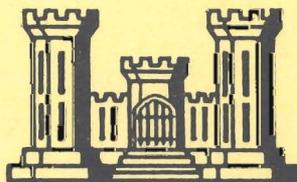


STANDARD
OPERATION AND MAINTENANCE
MANUAL

FOR THE
SACRAMENTO RIVER
FLOOD CONTROL PROJECT
(REVISED MAY 1955)



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

CORPS OF ENGINEERS

U. S. ARMY

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SACRAMENTO RIVER FLOOD CONTROL PROJECT

Prepared by the Sacramento District
Corps of Engineers, U. S. Army
Sacramento, California dated May 1955

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EXHIBIT INDEX

Exhibit

Description

A	Flood Control Regulations, Maintenance and Operation of Flood Control Works
B	"As Constructed" drawings Unattached (to be contained in supplements)
C	Control of Sand Boils, caving and bank protection, etc. Plates 1 to 10, incl.
D	Levee Inspection Report, Check List No. 1
E	Check Lists of Levees, Channel and Structures Unattached (to be contained in supplements)
F	Letter of Acceptance by State Reclamation Board Unattached (to be contained in supplements)
G	Suggested Semi-annual Report Form Unattached (to be contained in supplements)

STANDARD OPERATION AND MAINTENANCE MANUAL

of the

SACRAMENTO RIVER FLOOD CONTROL PROJECT

SECTION I

INTRODUCTION

1-01. Authority. The Sacramento River Flood Control Project was authorized by the Flood Control Act of 1 March 1917, Public 367 - 64th Congress, (H. Doc. 81, 62nd Congress, 1st Session, as modified by Rivers and Harbors Committee Doc. No. 5, 63rd Congress, 1st Session), and modified by the Flood Control Act of 15 May 1928, Public No. 391-70th Congress, (S. Doc. No. 23, 69th Congress, 1st Session), the River and Harbor Act of 26 August 1937, Public 392, 75th Congress, 1st Session, (Senate Committee Print 75th Congress, 1st Session), and the Flood Control Act of 18 August 1941, Public 228, 77th Congress, 1st Session), (H. Doc. No. 205, 77th Congress, 1st Session).

1-02. Purpose of the Manual. The purpose of this manual is to present general information for use by local interests who maintain and operate the various geographical units comprising the Sacramento River Flood Control Project. This general information applies to all units of the project and conforms with Section 208.10, Title 33 of the Code of Federal Regulations as approved by the Acting Secretary of Army on 9 August 1944, and published in the Federal Register of 17 August 1944. A copy of the approved regulations is bound in this volume as Exhibit A. Detailed information for each separate unit will be furnished under a separate Supplement Manual to be prepared when each unit is completed.

1-03. Location and Description. The Sacramento River Flood Control Project is located on the Sacramento River and the lower reaches of its principal tributaries in north-central California. The principal features of the project extend from Ord Bend downstream to Collinsville near the mouth of the river, a distance of 184 miles, and include a comprehensive system of levees, overflow weirs, drainage pumping plants, and flood bypass channels. This composite flood control project represents many years of planning and incorporates many plans of Federal and State agencies and local interests. The present project provides for the enlargement of the Sacramento River channel below the mouth of Cache Slough (about 20 river miles upstream from Suisun Bay); for making two cutoffs between the mouth of the Feather River and Colusa; for the construction of four bypass weirs and the reconstruction of Tisdale Weir; for construction of outfall gates at the mouth of Butte Slough

and at Knights Landing; for levees along certain reaches of the main river and tributaries; for drainage pumping plants on the east side of the Sutter Bypass; for bank protection work and levee set-backs on the main river and tributaries from Ord Bend to Collinsville; for maintenance of the enlarged river channel below Cache Slough during construction, including revetment of the banks of the cut; and for maintenance and operation of gaging stations on navigable rivers and streams during the construction period. The project also includes channel clearing, rectification, snagging, and bank protection along the Sacramento River and tributaries in Tehama County and from Red Bluff southerly. A map showing the location of the features of the project is included in the front of this manual.

1-04. Protection Provided. The Sacramento River Flood Control Project, when completed, will provide adequate protection from all floods of record to about 800,000 acres of fertile agricultural lands; to the cities of Colusa, Yuba City, Marysville, Sacramento, North Sacramento, West Sacramento and about eleven smaller communities; to other areas developed for residential and industrial purposes; to two transcontinental railways, one transcontinental highway, and other feeder railways and numerous State and County highways. It will make possible the reclamation of swamps and other areas which can be developed to a high degree when protection against flood hazard is assured.

1-05. Construction History. Prior to 1850, low levees were first constructed in the Sacramento Valley by a few individual landowners to protect their properties from inundation. Between the years 1855 and 1871 about 1,000,000 acres of swamp and overflow lands were transferred from Federal ownership to State ownership and in turn were sold to private interests. In an effort to reclaim these lands, levees were extended, encroaching on the streams and confining the waters. Landowners then formed reclamation districts around which they constructed higher and more substantial levees to provide more protection. Federal participation in the improvement of the Sacramento River for flood control began with the Act of 1 March 1917, and continued under subsequent Acts as mentioned in paragraph 1-01.

SECTION II

LOCAL COOPERATION

2-01. Federal Requirements. The Act of 18 August 1941, provides that "The projects for the control of floods and other purposes in the Sacramento River, California, adopted by the Acts approved March 1, 1917, May 15, 1928, and August 26, 1937, Public 392 (Senate Committee Print, 75th Congress, 1st Session), are hereby modified substantially in accordance with the recommendation of the Chief of Engineers in House Document Numbered 205, Seventy-seventh Congress, first session."

The recommendation of the Chief of Engineers contained in House Document 205, 77th Congress, 1st Session, provides for the "completion of the Sacramento Valley Flood Control Project _____ subject to the provisions that the State of California, or responsible local agencies give assurances satisfactory to the Secretary of War that they will provide, without cost to the United States, all lands, easements and rights-of-way necessary for the completion of the project; bear the expense of necessary highway, railroad, and bridge alterations; hold and save the United States free from claims for damages resulting from construction of the works; and maintain and operate all works, after completion, in accordance with regulations prescribed by the Secretary of War."

2-02. State Legislation.

a. Adoption of Federal Policy. The original legislation adopting Federal policy requiring local interests to give assurances of local cooperation was enacted by the State of California on 22 June 1939, as outlined in State Senate Bill No. 950, Chapter 656. This legislation was later incorporated under Chapter 1528, Statutes of 1947, which amends Article 2 and adds Articles 4, 5, and 6 to Chapter 3, Part 2, Division 5 of the State Water Code. The approval and adoption by and on behalf of the State of California of the conditions, plans, construction and mode of maintenance and operation of works within the Sacramento River Flood Control Project set forth in Senate Committee Print, 75th Congress, 1st Session, as authorized and approved by the Act of Congress, Public No. 392, 75th Congress, approved 26 August 1937, including the holding and saving the United States from damages due to construction works are continued in effect.

b. Powers and Duties of Department of Public Works and Reclamation Districts include the following:

"8360. On behalf of the State the Department of Public Works, acting by and through the State Engineer, has supervisory powers over the maintenance and operation of the flood control works of the Sacramento River Flood Control Project.

"8361. The department, acting by and through the State Engineer, shall maintain and operate on behalf of the State the following units or portions of the works of the Sacramento River Flood Control Project, and the cost of such maintenance and operation shall be defrayed by the State."

(a) The east levee of the Sutter By-pass north of Nelson Slough.

(b) The levees and channels of the Wadsworth Canal, the intercepting canals draining into it, and all structures incidental thereto.

(c) The collecting canals, sumps, pumps and structures of the drainage system of Project No. 6 east of the Sutter By-pass.

(d) The by-pass channels of the Butte Slough By-pass, the Sutter By-pass, the Tisdale By-pass, the Yolo By-pass and the Sacramento By-pass with all cuts, canals, bridges, dams and other structures and improvements contained therein and in the borrow pits thereof.

(e) The levees of the Sacramento By-pass.

(f) The channels and overflow channels of the Sacramento River and its tributaries within the Sacramento and San Joaquin Drainage District.

(g) The Knights Landing ridge cut flowage area.

(h) The flood relief channels controlled by the Moulton and Colusa Weirs and the training levees thereof.

(i) The levee on the left bank of the Sacramento River adjoining Butte Basin, from the Butte Slough outfall gates upstream to a point four miles northerly from the Moulton Weir, after completion.

(j) All weirs and relief structures.

(k) The west levee of the Yolo By-pass, extending from the west end of the Fremont Weir southerly to the Cache Creek Settling Basin and the east levee of the Yolo By-pass from the Fremont Weir southerly two miles.

(l) The levee on the west bank of Feather River extending a distance of about two miles southerly from the Sutter-Butte Canal headgate.

(m) The levees of Cache Creek and the easterly and westerly levees of Cache Creek settling basin.

"8370. It is the responsibility, liability and duty of the reclamation districts, levee districts, protection districts, drainage districts, municipalities, and other public agencies within the Sacramento River Flood Control Project limits, to maintain and operate the works of the project within the boundaries of jurisdiction of such agencies, excepting only those works enumerated in Section 8361 and those for which provision for maintenance and operation is made by federal law."

c. Establishment of Maintenance Areas.

As amended by Chapter 1528, the State Water Code sets forth a procedure, available when necessary, whereby adequate and uniform maintenance of flood control projects may be secured. In substance, when the State Engineer finds that there is a failure on the part of local agencies to properly maintain project works or that a local agency no longer desires to carry out project maintenance, a report to that effect is made to the State Reclamation Board, which is empowered, after hearing, to form a "maintenance area" and thereafter the Department of Public Works maintains that particular unit of project works, and the Reclamation Board apportions the cost thereof upon the property benefited within the "maintenance area" on an ad valorem basis and the assessment is extended for collection together with county taxes on the county assessment roll.

SECTION III

GENERAL

3-01. General Rules and Procedures. The general rules for maintenance and operation of local flood-control works are, as follows:

a. 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.

b. The State of California, the responsible local agency, which furnished assurance that it will maintain and operate flood control works of the Sacramento River Flood Control Project in accordance with regulations prescribed by the Secretary of Army 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.

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

d. 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.

e. 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, Corps of Engineers, 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.

f. 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.

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

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

i. 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.

j. The District Engineer 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. When special conditions do not permit full compliance with the general provisions of the Federal Control Regulations, or when conditions peculiar to a unit require additional care or attention, such supplement instructions will be contained in the Supplement Manual concerned.

3-02. Clarification of Duties. Most of the general duties outlined above are self-explanatory; however, amplification of items b, e, f and i, is considered advisable to insure common interpretation. Therefore, the remainder of this section of the manual furnishes suggestions for complying with those requirements.

3-03. Duties of Superintendent. Details of the duties of the Superintendent will be developed in other portions of the manual. The general duties should include the training of key personnel in such a manner that all contingencies may be handled in an expeditious manner. The Superintendent should ascertain that all of his key men have read those portions of the operation and maintenance manual pertaining to their duties. The Superintendent should have available the names, addresses and telephone numbers of all his key men and a reasonable number of substitutes therefor. These key men should, in turn, have similar data on all of the men necessary for assistance in the discharge of their duties. The key men should include the following:

a. An assistant to act for and in the absence of the Superintendent.

b. Section leaders in sufficient number to lead maintenance patrol work of the entire levee during flood fights. High qualities of leadership and responsibility are necessary for these positions.

The name and address of the Superintendent appointed by local interests to be responsible for the continuous inspection, operation and maintenance of the project works shall be furnished the District Engineer, and in case of any change of Superintendent, the District Engineer shall be so notified.

3-04. Proposed Improvements or Alterations. Drawings or prints or proposed improvements or alterations to the existing Flood Control Works must be submitted for approval to the District Engineer, Sacramento District, Corps of Engineers, Sacramento, California, sufficiently in advance of the proposed construction to permit adequate study and consideration of the work. Drawings or prints, in duplicate, showing any improvements or alterations as finally constructed should be furnished to the Corps of Engineers after completion of the work.

3-05. Semi-annual Report. The semi-annual reports required under Paragraph 208.10(a)(6) of the regulations should be submitted within a ten day period prior to 1 June and 1 December of each year and should include all dated copies of reports of inspections made during the period of report. Also, the nature, date of construction, and date of removal of all temporary repairs and the dates of permanent repairs should be included in this report. Other items and suggestions relative to public cooperation, public sentiment on the protection obtained, and other allied subjects are considered pertinent and desirable data for inclusion in the report, but are not required. A suggested form for the Semi-annual Report is included as Exhibit G of the Supplement Manuals.

3-06. Coordination with Operation of Public and Private Facilities. The Superintendent should have specific knowledge of all pertinent public utilities and private facilities located within the unit for which he is responsible in order to coordinate all phases of the flood fighting activities. Such knowledge should be extended to include the names, telephone numbers and addresses of all persons who might necessarily be contacted in case of damage to highway roads and bridges, railroads, power lines, telephone lines, gas lines or structures.

3-07. Safety Requirements. Since patrolling of levees, maintenance of channels and operation of irrigation or drainage structures will expose operating personnel to certain hazards, it is suggested that all pertinent safety codes be incorporated into operating procedures and that permanent operating personnel or temporarily employed personnel be given the necessary protective equipment and apparel together with instructions to conduct their work without undue exposure to existing hazards. Watchmen or patrols employed during flood periods should consist of teams of not less than two men.

3-08. Stream Flow Stages. Permanent arrangements should be made by the Superintendent with the Corps of Engineers at Sacramento, California, to secure stream flow stages and forecasts of stream flow stages and weather conditions of effected streams and drainage areas to properly plan adequate measures of protection.

3-09. Periodic Inspections. Inspections should be made by the Superintendent at the times specified below:

a. During the month of October, which is prior to the beginning of the flood season.

- b. Immediately following each major high water period.
- c. In the absence of high water, at periods not exceeding 90 days.
- d. At intermediate times as necessary.

3-10. Check Lists. The check lists shown in Exhibit D and E, should be used in each inspection to insure that no features of the protective system are overlooked. Items requiring maintenance should be noted thereon; if items are satisfactory they should be so indicated by a check. Exhibit E will be furnished by the Sacramento District Engineer as provided under paragraphs 4-03, 5-03, 6-03 and 7-03 of this manual.

3-11. Drawings. Detailed "As Constructed" record drawings and data necessary for the operation and maintenance of the protective works are included as Exhibit B of the supplement manuals.

SECTION IV

LEVEES

4-01. Description. The Sacramento River Flood Control Project has been divided into geographical units for ease of reference. These units usually conform to political subdivisions which are responsible for operation and maintenance of the project units within their boundaries. Levees of the various units are described in detail in the applicable Supplement Manuals which are prepared after completion of the construction work within the units. The extent of the levee system of the Sacramento River Flood Control Project is shown on the map in the front of this manual. The levees of the Project are constructed generally with a crown width of 20 feet, with landside slopes of 1 on 2 and riverside slopes of 1 on 3. Some bypass levees and some river levees do not have the standard slopes or crown widths. On the Sacramento River and tributaries the levee grade provides for a freeboard of 3 feet above adopted flood plane profile (5 feet freeboard below the mouth of Cache Slough) and on the bypass levees the freeboard is 6 feet. Reasons for departure from the standard conditions are explained in the Supplement Manuals. Patrol roads, earthen ramps, road crossings and turn-outs have been constructed at intervals or wherever necessary throughout the length of the levees.

4-02. Maintenance. Applicable portions of the Flood Control Regulations, paragraph 208.10(b)(1), pertaining to maintenance are quoted as follows:

"(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. * * * * Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being 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; (see also paragraph 4-05 a)
- (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 paragraph 4-05 b)
- (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."

4-03. Check Lists. A suggested check list form for reporting inspections of the levee is contained in this manual as Exhibit D. Additional check lists are contained in the Supplement Manuals as Exhibit E. As many copies of the form as are necessary to record all needed maintenance should be used for reporting such inspections.

4-04. Operation. Applicable portions of the Flood Control Regulations, paragraph 208.10(b)(2), are quoted 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 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."

4-05. Special Instructions.

- a. Revetment work. Due to the fact that many reaches of levees with their contiguous banks have been constructed with stone protection work consisting of quarry stone or cobbles, the provisions of paragraph 4-02(b)(vi) are expanded to include the following:
 1. Where scour, wash, settlement or failure of a portion of the originally provided stone protection has been noted, or where inspection indicates that such damage may result during the next flood or high water period, the scour or wash shall be filled with earth free from brush, roots, sod or other unsuitable material and additional stone shall be placed upon the earth fill to bring the stone protection to its original section. In case of emergency and when stone is not available, sand bags or bags filled with gravel may be used for temporary repair measures.
 2. When permanent repair of the stone protection is made, the stone used shall, as far as possible, be similar to the kind and gradation as originally used, and shall be

placed to the thickness as shown on the drawings of Exhibit B. In the reach of the Sacramento River downstream from Walnut Grove where the levees are subject to excessive wave wash and at other locations where filter was originally placed or where it may be required, repair of stone protection will include the placement of a properly graded six inch filter layer under the stone protection.

3. In the event an inspection reveals that due to scour, settlement or other causes, stone protection on the levee or bank is required beyond the limits of the original construction or in reaches of the levee or bank not originally provided with such protection, local interests will provide additional sloping of the bank and placement of stone protection as needed to protect completed work. The work shall be done in a manner acceptable under standard engineering practice. Drawings or prints showing such improvements or alterations shall be furnished the District Engineer after completion of the work.

b. Care of vegetation on levee. Due to conditions peculiar to this area, the growth of sod on the levee slope is not practicable. Accordingly, the following special instructions are furnished in lieu of paragraph 4-02(b)(vii) of the prescribed general regulations:

1. The Superintendent shall provide for clearing of brush, trees, and other wild growth from the levee crown and slopes. Brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash.
2. Weeds, grasses, and debris on the levee may 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. Grass and weeds on levee slopes should be mowed where removal by burning is dangerous or impracticable, such as on peat levees or where burning would constitute a hazard."

- c. 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 matter. 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.
- d. 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.
- e. 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.

Compliance with the provisions prescribed in the general regulations quoted in paragraph 4-02 above and with the special instructions is essential for the efficient maintenance of the levee system covered by this manual and for the successful operation of the entire Sacramento River Flood Control Project.

SECTION V

IRRIGATION AND DRAINAGE STRUCTURES

5-01. Description. This section of the manual deals with the numerous irrigation and drainage structures which pass through, under or over the levees to provide for the passage of water from the waterway to the protected area for irrigation or other usage or from the protected area to the waterway for drainage purposes. In general, these structures are constructed of corrugated metal pipes, steel pipes or reinforced concrete pipes or culverts all controlled on the riverside with positive closure devices accessible during high water or with automatic flap gates. Detailed descriptions of the individual structures are contained in the applicable Supplement Manuals.

5-02. Maintenance.

a. Flood Control Regulations. Applicable portions of the Flood Control Regulations, paragraph 208.10(d)(1) pertaining to maintenance of irrigation or drainage structures are quoted 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 inspection."

b. At each inspection as required above, the following items, if applicable, shall be particularly noted:

- (1) Debris or other obstructions to flow.
- (2) Damage or settlement of pipe.
- (3) Condition of concrete-cracks, spalls, erosion.

c. Maintenance.

(1) All eroded concrete shall be repaired as soon as erosion reaches a depth of 4 inches or any reinforcing steel is exposed. All evidences of settlement, uplift, or failure of concrete 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 lowlying pockets in back of the levee. Plans for the maintenance of drainage facilities at any such points should be submitted to the State Engineer for approval before such work is started.

5-03. Check Lists. A form suggested as a check list for reporting inspections of drainage structures will be found in the Supplement Manuals, Exhibit E. As many copies of the form as necessary to record all needed maintenance should be used for reporting such inspections.

5-04. Operation. Applicable portions of the Flood Control Regulations, paragraph 208.10(d)(2), are quoted 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 any object which might prevent closure of the gate shall be removed. Automatic 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."

5-05. Additional Requirements.

a. Inspection. Periodic inspections should be made to insure that all facilities are in good operating conditions as follows:

- (1) Since the outlets of pipes crossing under the levee are inundated at relatively low river stages, all pipes crossing under the levee should be inspected considerably in advance of the beginning of the flood season. The gates on these pipes should be checked at the same time.
- (2) Inspection of all drainage structures should also be made following each major high water period.
- (3) Otherwise at periods not exceeding 90 days.

b. Check Lists for Inspection of Drainage Structures. Check lists suggested under Exhibit E of the Supplemental Manuals should be used in each inspection to insure that structures are kept in working condition at all times. Exhibit E will be furnished by the Sacramento District Engineer as provided under paragraph 5-03 of this manual.

c. Positive Closure Devices. It is essential that the prime function of the flood protection works cannot be nullified by back flow through irrigation and drainage structures. Accordingly, a reliable means of positive closure of conduits must be provided on the riverside of the protective works and such closure devices must be accessible during flood periods. Conduits through the flood protection works fall into two categories and the requirements for each are as follows:

- (1) Those located through the levee above the project flood plane. Emergency closure devices will not be required on those structures where they connect canals and drains which have ample capacity to handle any flow which might pass through the pipe during floods. Where such outlets are not connected to canals or drains of ample capacity an accessible closure device will be required on the river side.
- (2) Those located through the levee below the project flood plane. All structures installed by the Federal Government and all new structures to be installed under permit by local interests will be required to have an accessible closure device on the riverside of the levee. All existing structures which do not have an accessible closure device on the riverside of the levee will be modified by local interests to meet that criteria when the structure is rebuilt or modified in any way. Where it is evident that it may be some years before riverside closures will be provided on existing outlets which are at present ungated on that side, it is essential that local interests place, at an early date, an emergency flap gate on the riverside of each outlet now ungated on that side. The flap gate is to be equipped with a cable extension to

the levee crown, or other device to hold it open except when necessary to be released for emergency closure of the pipe.

5-06. Safety Requirements. In removing large objects which have lodged against gate structures during periods of high water, exposed workmen should be provided with life vests and, if necessary, should have a safety line attached to their person attended by another worker. Similar hazardous work in the vicinity of structures should not be attempted unless two or more persons are present.

Compliance with the maintenance provisions prescribed in Paragraph 5-02 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.

SECTION VI

CHANNELS

6-01. Description. The channels of the Project constitute that part of the waterway which lies between the levees of the Sacramento River from Ords Ferry to Collinsville; the channels of the lower reaches of the Feather and American Rivers; and all tributary and distributary streams. The area in general is shown on the map located near the front of this manual. More complete detailed descriptions and limits of channels are contained in the Supplement Manuals.

6-02. Maintenance.

a. Flood Control Regulations. Applicable portions of the Federal Flood Control Regulations, Paragraph 208.10(g)(1), pertaining to maintenance of channels are quoted 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. . ."

b. Other Maintenance Requirements. The purpose of the floodflow channels inspection and maintenance is to insure that conditions which affect the channel capacity will remain substantially the same as those considered in the design assumptions and that no new conditions develop that may affect the stability of the project structures. Channel maintenance along navigable waterways relates to such maintenance as is required for flood control and is not to be confused with the snagging, clearing and dredging operations carried on by the United States in conjunction with maintenance of Federal navigation projects. Maintenance along channels which are not navigable waterways are the sole responsibility of local interests when such channels must be maintained to a certain capacity for flood control. Particular attention will, therefore, be given the following:

(1) 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.

(2) Operations of any nature upstream from the project that would affect flow conditions.

(3) 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 cleaned out and unobstructed at all times.

(4) 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.

(5) Sediment, rubbish, industrial waste or any 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.

(6) All eroded concrete shall be repaired as soon as reinforcing steel is exposed or erosion reaches 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, deviation from grade, uplift, or failure of concrete structures shall be referred to the State Engineer for analysis and remedial measures.

(7) All damage to fencing, posts, barbed wire or galvanizing 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.

(8) Earth fills should be checked for settlement, erosion of levee slopes, excessive seepage or saturation area back of fills and condition of bank protection - concrete or stone blanket.

(9) Right-of-way should be checked for presence of dumped refuse and encroachment of trespass.

6-03. Check Lists. A form suggested as a check list for reporting inspections of the channel will be found in the Supplement Manual, Exhibit E. As many copies of the form as necessary to record all needed maintenance should be used for reporting such inspections.

6-04. Operation.

a. 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."

6-05. Safety Requirements.

a. Clearing of channels present hazards which, unless foreseen and guarded against, may result in serious consequences. Clearing the channel of growing vegetal matter involves the use of axes, brush-hooks or other sharp edged hand tools. In order that the work may be accomplished with a minimum of exposure, the following precautions should be observed:

(1) Instruct employees in proper use of tools and equipment.

(2) Keep tools sharp and inspect tools for possible loose or warped handles or lack of proper wedges.

(3) Allow sufficient distance between workers..

(4) Clear area of branches or vines which might deflect swing of axe.

(5) When clearing channel of debris, workmen should be cautioned to keep a sharp lookout for poisonous snakes.

(6) Extra care should be taken to prevent exposure of susceptible workmen to poison oak.

(7) Should it become necessary to remove large objects which have lodged against the bank or which are causing an obstruction to the flow, during the period of high water, workmen who may be exposed to water hazards should be provided with life vests and, if necessary, should have a safety line attached to their person, attended by another worker.

SECTION VII

MISCELLANEOUS FACILITIES

7-01. Description. Miscellaneous structures or facilities which are constructed as a part of, or exist in conjunction with the protective works, and which might affect their functioning, include bridges, utility crossings, hydrographic facilities, road crossings and other structures not classified as drainage or irrigation facilities. Detailed description of individual structures or facilities pertinent to each unit will be contained in the supplement manual.

7-02. Maintenance.

a. Applicable portions of the Federal Regulations, paragraph 208.10(h)(1), are quoted 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 Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be replaced without delay. . ."

b. Inspection of the miscellaneous facilities and maintenance requirements 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 Exhibit E, as shown in the Supplement Manuals.

c. The interest of the Corps of Engineers and the responsibility of the local interests in the existing highway and railroad bridges is primarily confined to their effect on the safety and functioning of the flood control works. However, 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 responsible agencies. 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 on the action taken by the owner shall be submitted to the District Engineer to accompany the next semi-annual report.

7-03. Check Lists. A check list for miscellaneous structures has not been prepared. A check list similar to that found in the Supplement Manual, Exhibit E, may be used by local interests.

7-04. Operation.

a. Flood Control Regulations. Applicable portions of the Federal Flood Control Regulations, paragraph 208.10(h)(2), are 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 therefor."

SECTION VIII

SUGGESTED METHODS OF COMBATING FLOOD CONDITIONS

8-01. General. 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. Corps of Engineers, Sacramento, California, and subsequently to 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 are 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.

8-02. Earthen Levees. An earthen levee is in danger whenever there is water against it. This danger increases with the height of the water, the duration of the flood stage, and the intensity of either the current or wave action. A well-constructed levee of correct cross section should, if properly maintained and not overtopped, hold throughout any major flood. Threatened failures, such as sand boils, sinking levees, slides, or sloughing can be met if prompt action is taken and proper methods of treatment are used.

8-03. Premeditated Damage. In the event of an extraordinary flood requiring a fight over long stretches of levee on both sides of a river, there is a natural temptation to attempt some relief from the strain by breaking the opposite levee. The Superintendent should continually guard against premeditated damage to the levee, and when the situation demands, immediate action should be taken to establish adequate protective forces.

8-04. 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 vests with the local interests through local and State Governmental agencies.

8-05. Inspection of Flood Control Works. Immediately upon receipt of information that a high water is imminent, the Reclamation Districts through their Superintendents, 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.

8-06. 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. When 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.

8-07. Disaster Relief. It is the primary responsibility of local, State, and municipal authorities, supported by or working in connection with the American Red Cross to adopt measures for the relief of flood disaster victims. The primary mission of this District is to maintain the integrity of flood control works. However, relief measures may be undertaken by the Sacramento District in extreme cases and under compelling circumstances where local resources are clearly inadequate to cope with the situation.

8-08. General Methods of Treatment. After the above preliminary organization and precautions have been completed, the "flood-fight" itself commences. The methods of combating various defects in an earthen levee as described in the following paragraphs have been proved effective during many years of use by the Corps of Engineers. The time, manpower, and materials expended on the corrective measures shown below have an equal importance as attending the details of the closure structures, and other portions of the system as described elsewhere within this manual.

8-09. Sand Boils.

a. General. A sand boil is the result of a transfer of pressure head and seepage from the river through a pervious stratum near or at the surface of the landside of the levee. This seepage under pressure

tends to push its way to the surface and actually floats the material through which it flows. If the weight of the more impervious soil overlying the pervious stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure, no harmful effects results. When the soil stratum overlying the pervious layer fails to counterbalance the upward pressure, or when no such stratum exists, boils break through the landward surface. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

b. Effects of Sand Boils. Sand boils can produce three distinctly different effects on the levee, as illustrated on Plate 6, Exhibit C. In Figure 1, the seepage flow develops a very definite pipe or tube under the levee which breaks out at the landward toe in the form of one or more large sand boils. Unless checked, a cavern is created under the levee, causing subsidence and subsequent overtopping. Slumping of the levee will identify this type. Figure 2 illustrates how pressurized seepage water flows under the levee without following a well-defined path, and results in one or more boils outcropping at or near the landward toe. The flow from these boils tends to produce sloughing of the slope, and is evidenced by cutting and ravelling at the landward toe. Figure 3 shows a third type of effect of a sand boil, wherein numerous small boils, many of which are scarcely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, a group of boils causes flotation of the soil, erosion of the toe, and ultimate failure of the slope through sliding.

c. Method of Treatment.

(1) The accepted method of treating sand boils is to construct a ring of sandbags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt (see Plate 1, Exhibit C). The usual practice of ringing a sand boil is, as follows:

(a) The entire base for the sack ring is cleared of debris, in order to provide a watertight bond between the natural ground and the sack ring.

(b) The sacks are then laid in a ring around the boil, with joints staggered, and with loose earth between all sacks.

(c) The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

(d) A V-shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off the water.

(2) Actual conditions at each sand boil will determine the exact dimensions of the ring. The necessary diameter and height of the ring will depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

(a) The base width should not be less than $1\frac{1}{2}$ times the contemplated height.

(b) "Weak" ground near the boil should be included within the ring, thereby preventing a break-through later.

(c) The ring should be of sufficient diameter to permit sacking operations to keep ahead of the flow of water.

(3) Where many boils are found to exist in a given area, a ring levee of sandbags should be constructed around the entire area and, if necessary, water should be pumped into the area to provide sufficient weight to counterbalance the upward pressure.

8-10. Sub-levees or Bow Levees. Sub-levees are smaller levees built to the landside of the main levee in order to form pools to reduce the effective water pressure on the landside and consequently prevent the formation of boils and movement of foundation material. If sub-levees in certain locations prove advisable, the following treatment is recommended: (a) siphons should be available for filling all sub-levees, and (b) when deemed necessary, the siphons should be put into operation and kept running until each sub-levee basin is filled. The siphons, of course, need not be run if the basin fills of its own accord from normal seepage.

8-11. Sloughs. If any sloughs develop in the levees, all soft areas should be thoroughly drained by excavating shallow ditches (see Plate No. 7, Exhibit C), after which a single layer of willow brush, if obtainable, or any small trees or limbs should be laid up and down the slope, laying the butts up and tops down, and weighted with sacks (see Plate No. 10, Exhibit C). If the slope begins to slough down, a buttress of sacks should be built on the toe and extending up the slope. The buttress on the toe should be built in the shape of a small berm. No sacks or weight other than necessary to hold the brush in place should extend up the slope more than two-thirds of the distance from toe of slope to the fault.

8-12. 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.

8-13. 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. 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 usual 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.

8-14. Topping. Immediate consideration should be given the grade line of each levee section by comparison of existing grades with those shown on the drawings, "As Constructed", Exhibit B of Supplement Manuals. 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. If lumber is not available, a 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 $\frac{1}{3}$ 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.

c. Mud Box. Two types of mud box levees are shown on Plates No. 8 and 9, Exhibit C. The size of box is controlled by the conditions under which the box will function, available materials, method of placing the dirt, and the time element.

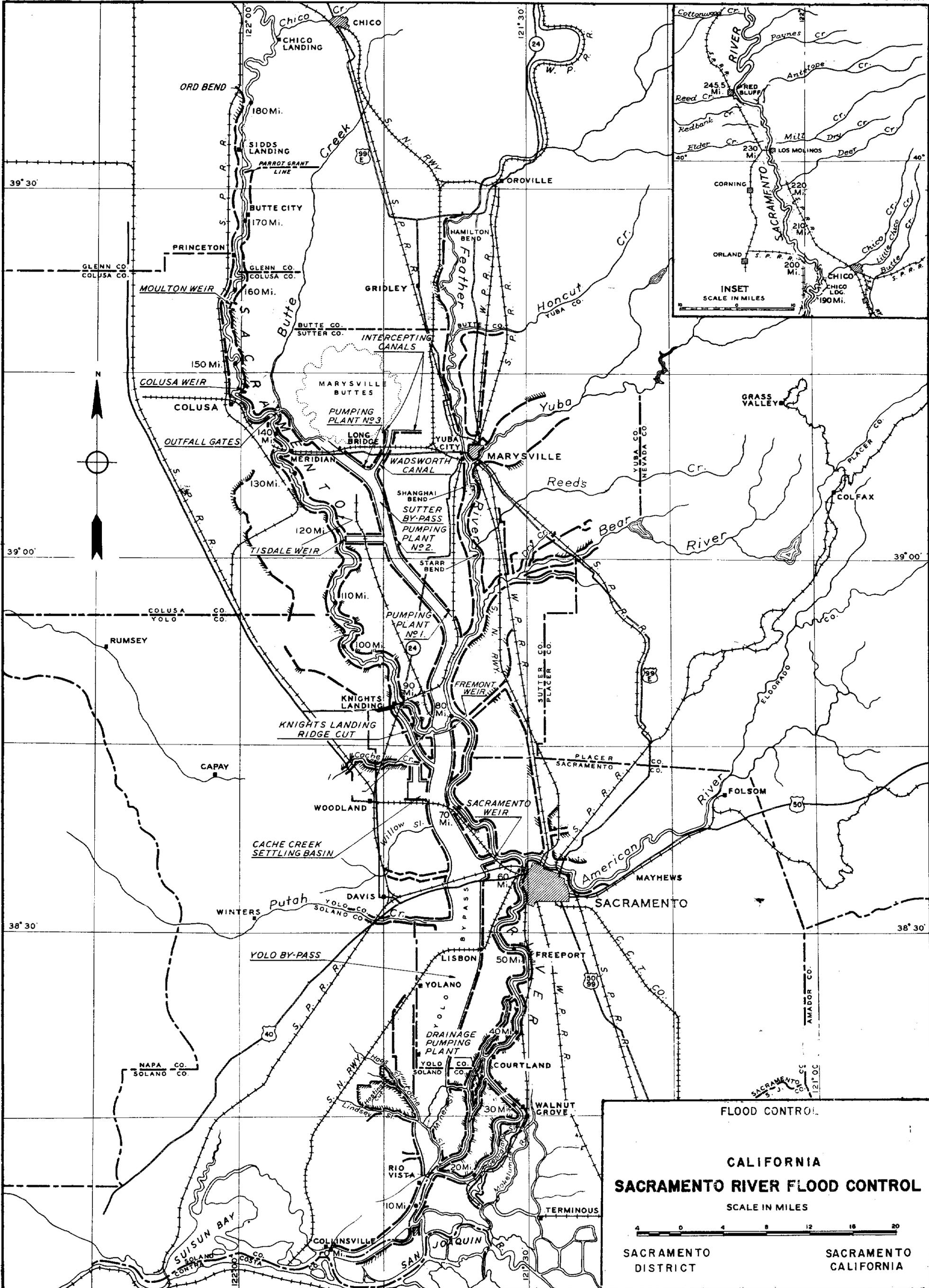
d. Cut-Crown Topping. This form of work should never be resorted to except in extreme emergency, when filled sacks and lumber cannot be secured.

8-15. 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.

8-16. 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 or "walkie-talkie" communication should be provided along dangerous stretches of the levee when travel or other satisfactory means of communication cannot be maintained.

8-17. Check Lists. The check lists shown in Exhibits D and E are furnished for reproduction and use by the local interests. These lists should be used in each inspection to insure that no features of the protective system are overlooked. Items requiring repairs should be noted thereon; if items are satisfactory, they should be indicated by a check mark.

8-18. Use of Government Plant. The District Engineer is authorized (Orders and Regulations, Par. 4227.12) to use or loan Government plant in sudden emergencies when life is in danger. The use of such plant is also permitted to save private property provided that no suitable private plant is available and that the plant can be spared without detriment to Government works.



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. 838; 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 right-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 drafts 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

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 SPEWFF)

[SEAL]

J. A. ULIO,
Major General,
The Adjutant General.

[P. R. Doc. 44-12285; Filed, August 16, 1944;
5:44 a. m.]

EXHIBIT "A" Sheet 2 of 2

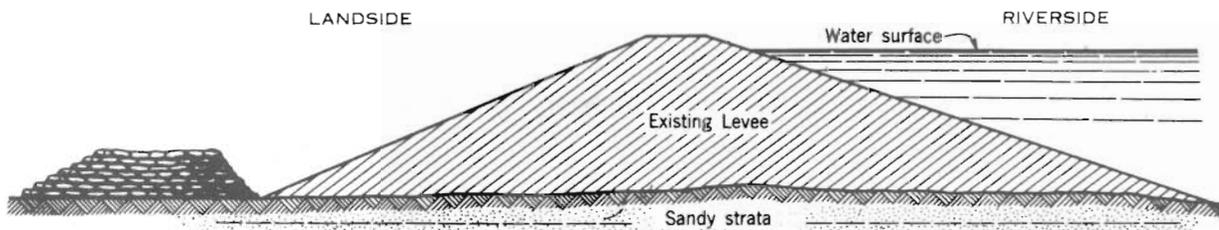
EXHIBIT B

**"AS CONSTRUCTED" DRAWINGS
(See Supplement Manuals)**

**EXHIBIT B
Unattached**

EXHIBIT C

PLATES OF SUGGESTED FLOOD FIGHTING METHODS



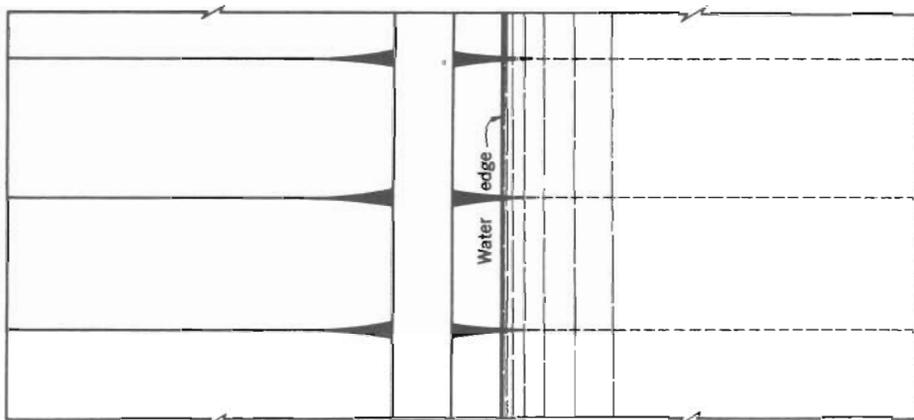
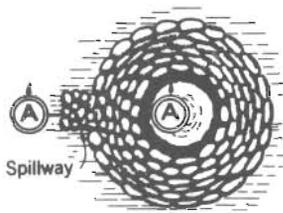
Note:

- Bottom width to be no less than $1\frac{1}{2}$ times height.
- Be sure to clear sand discharge.
- Tie into levee if boil is near toe.

ELEVATION



SECTION A-A



PLAN

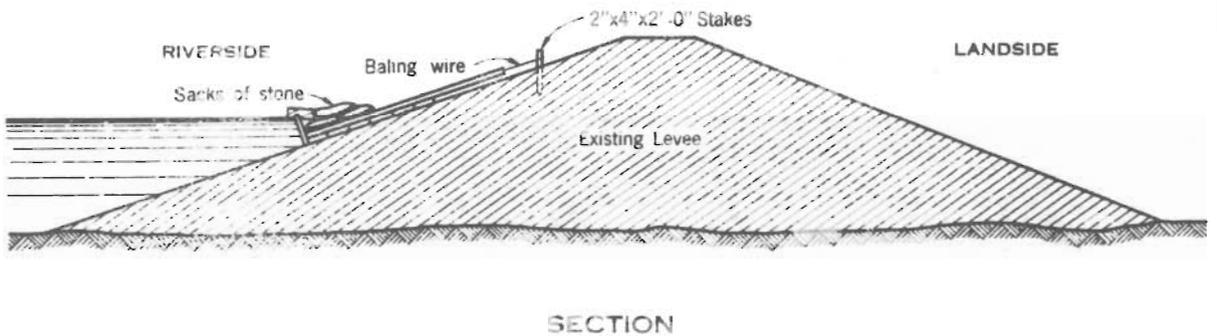
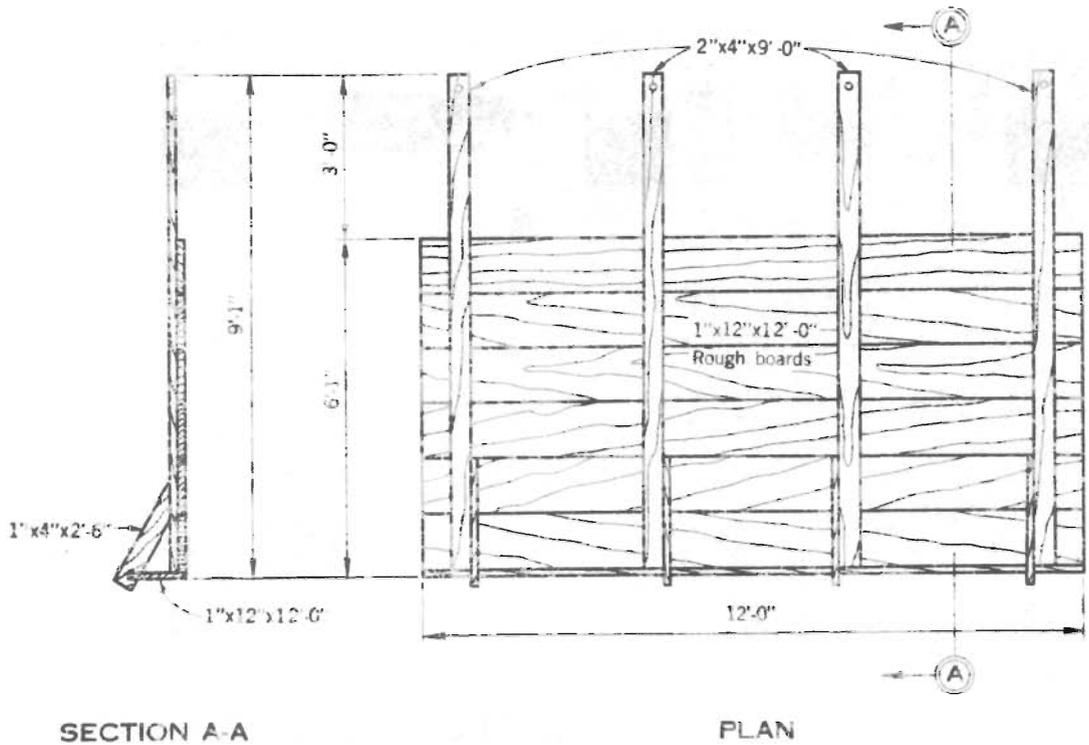
Note:

- 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.

SACRAMENTO RIVER , CALIFORNIA
FLOOD CONTROL PROJECT

CONTROL OF SAND BOILS

U.S. ENGINEER OFFICE , SACRAMENTO, CALIF.
MAY, 1946

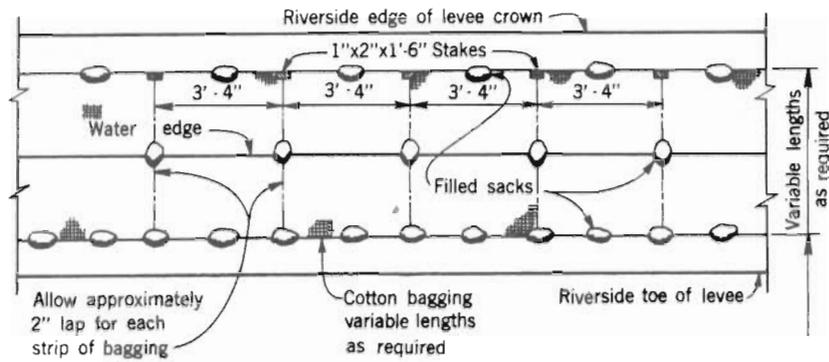


BILL OF MATERIAL FOR 100 FEET	
LUMBER	
56 pieces	1" x 12" x 12'-0"
32 pieces	1" x 4" x 2'-6"
32 pieces	2" x 4" x 9'-0"
* 32 pieces	2" x 4" x 2'-0"
* (Sharpened)	
WIRE	
200'	baling wire
NAILS	
4½ lbs.	8d nails

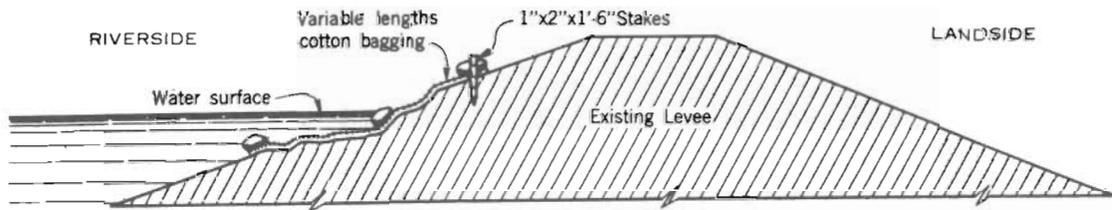
SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

MOVABLE
WAVE WASH PROTECTION

 U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.
 MAY, 1946



PLAN



SECTION

Note:

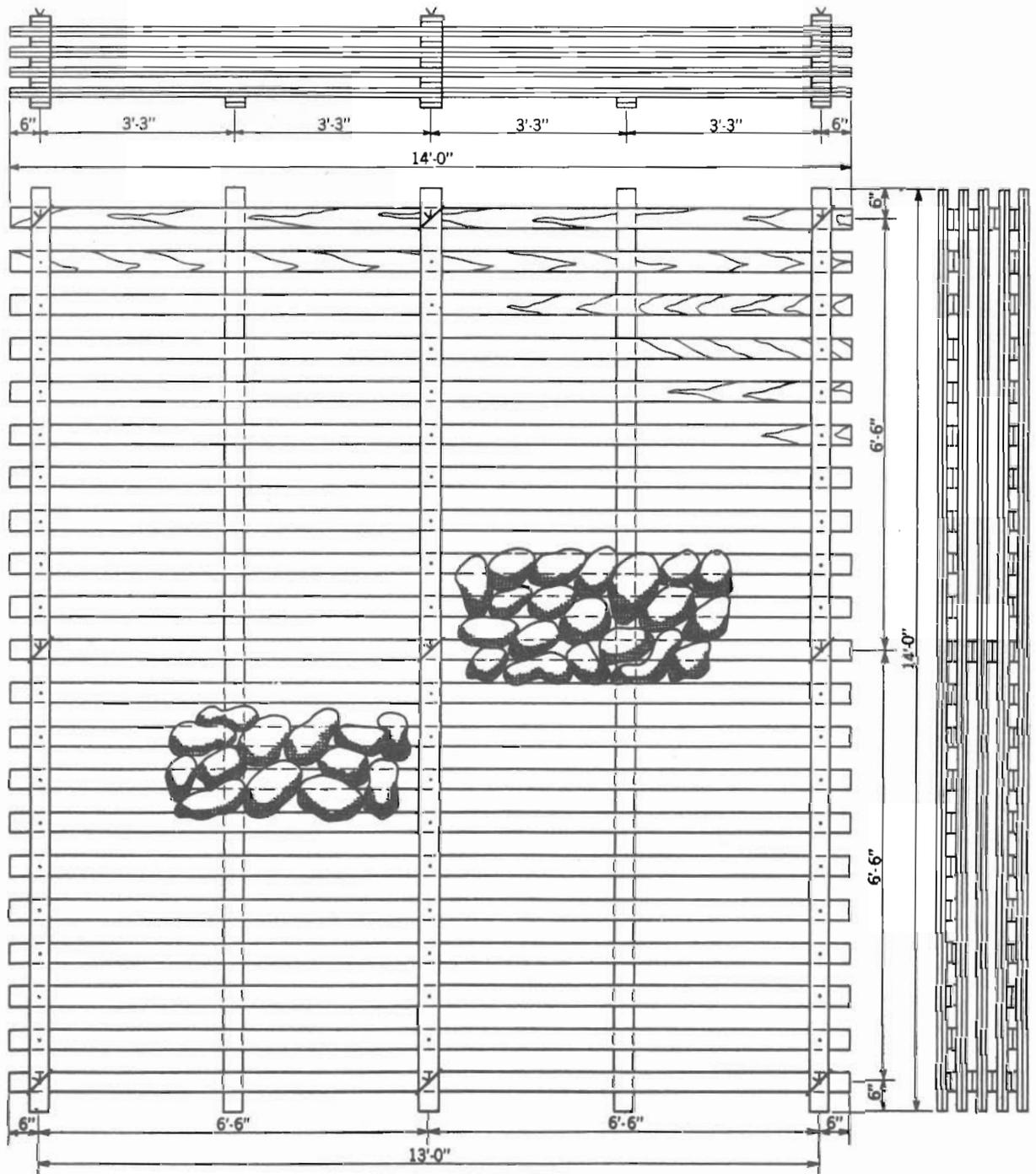
Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water surface. 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

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

WAVE WASH PROTECTION

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.
MAY, 1946



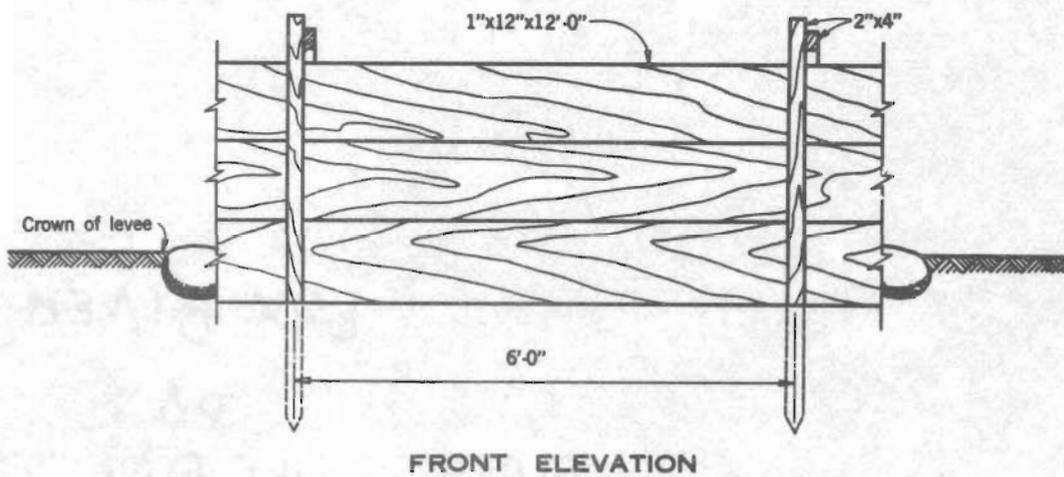
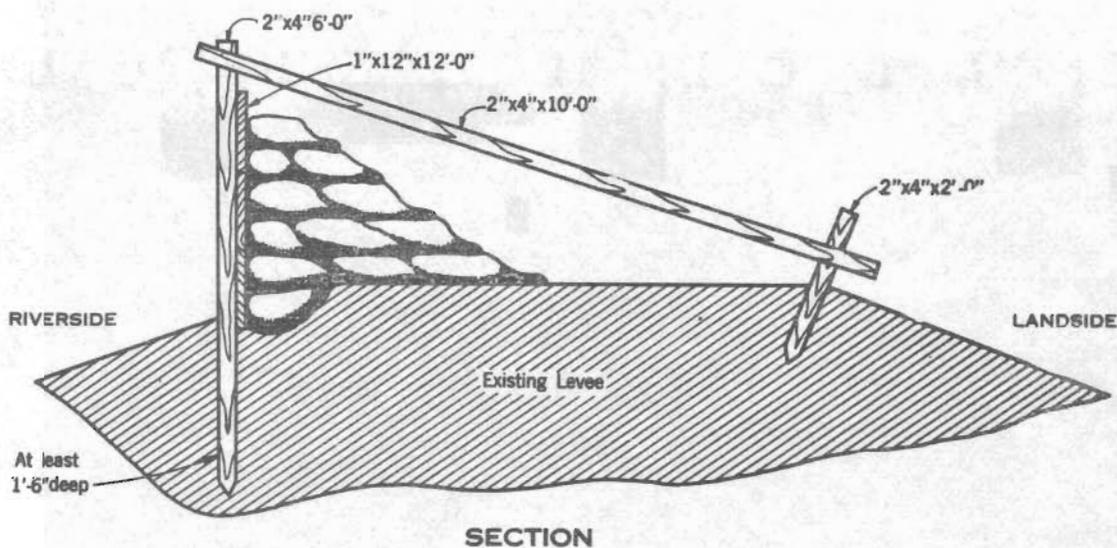
Note:
 Cribs constructed of double thickness of 1"x4"x14'-0" lumber. Nail all intersections with 1-20d nail. Each intersection of walls securely fastened by a loop of No. 9 wire, tightly twisted.

BILL OF MATERIAL FOR ONE CRIB 13'-0"	
LUMBER	
130 pieces	1"x4"x14'-0"
WIRE	
30'	No. 9 wire
NAILS	
22 1/2 lbs.	20d nails

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

CAVING BANK PROTECTION

 U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.
 MAY, 1946

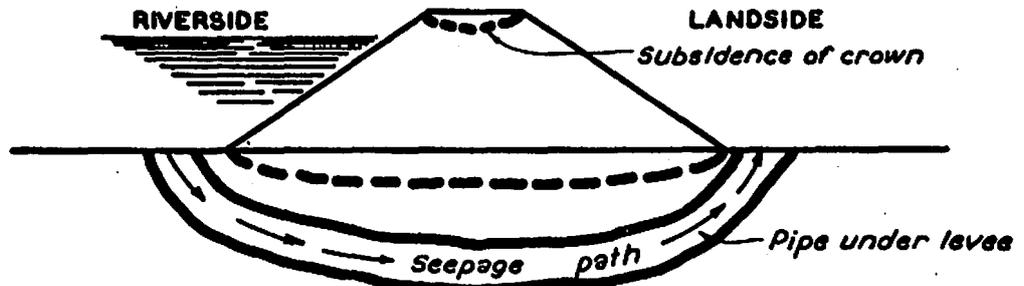


BILL OF MATERIAL FOR 100 LINEAR FEET OF LEVEE	
LUMBER	
25 pieces	1"x12"x12'-0"
17 pieces	2"x4"x10'-0"
* 17 pieces	2"x4"x6'-0"
* 17 pieces	2"x4"x2'-0"
* (Sharpened)	
NAILS	
1 lb.	-8d nails
2 lbs.	-16d nails
SANDBAGS	
1100	bags

SACRAMENTO RIVER, CALIFORNIA
 FLOOD CONTROL PROJECT

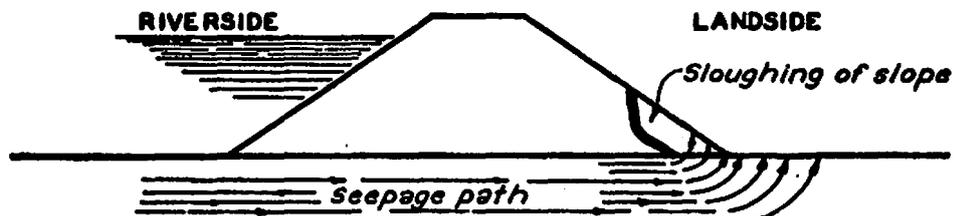
LUMBER AND SACK TOPPING

U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.
 MAY, 1946



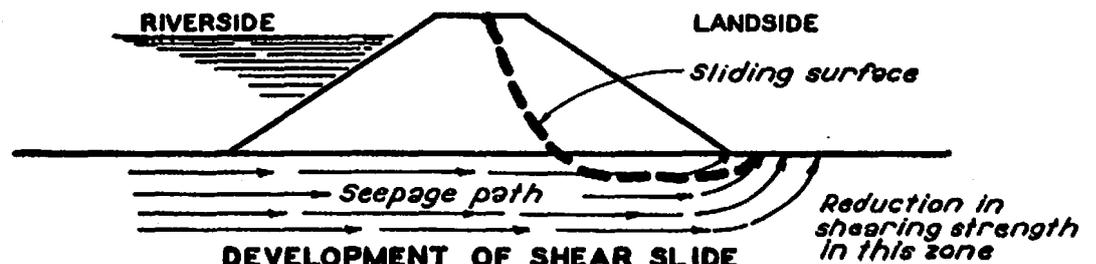
DEVELOPMENT OF PIPE UNDER LEVEE

FIG. 1



**SLOUGHING OF LANDSLIDE SLOPE DUE TO
RAVELLING AND UNDERCUTTING OF TOE**

FIG. 2



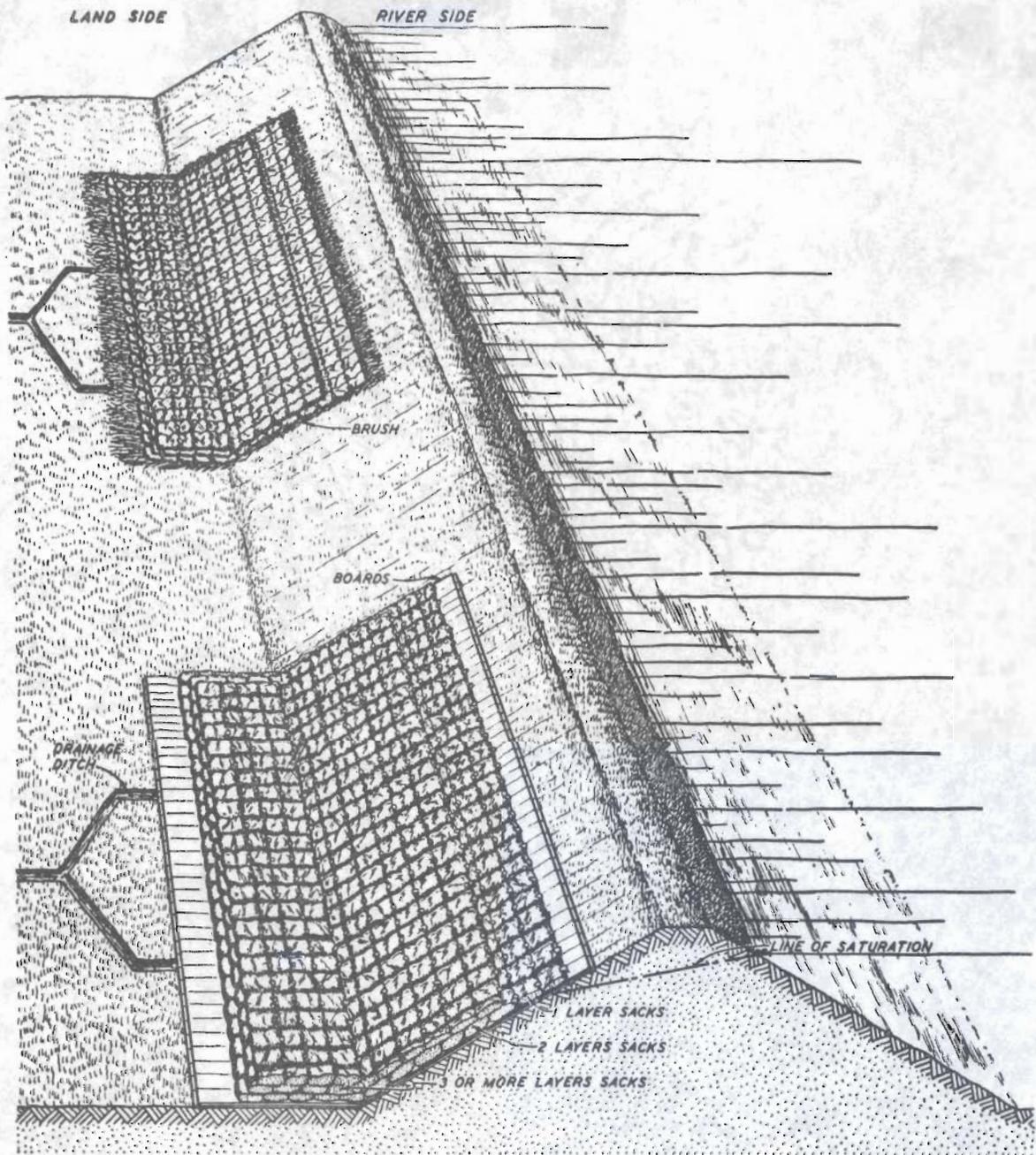
DEVELOPMENT OF SHEAR SLIDE

FIG. 3

**SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT**

**EFFECTS OF SAND BOILS
ON LEVEE**

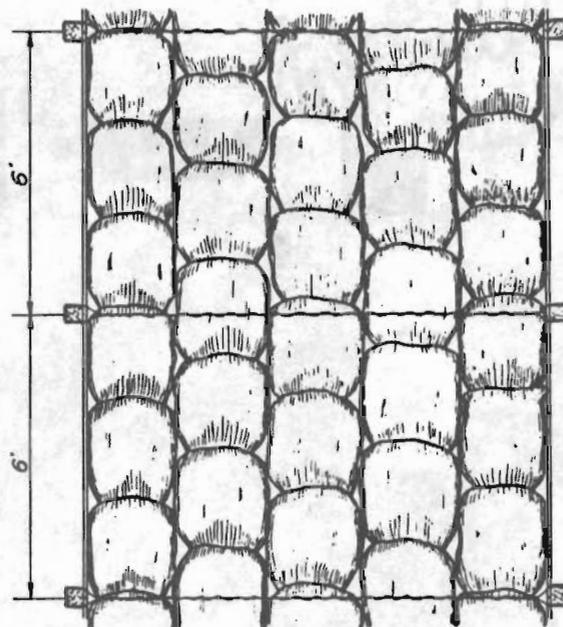
U.S. CORPS OF ENGINEERS, SACRAMENTO, CALIF.



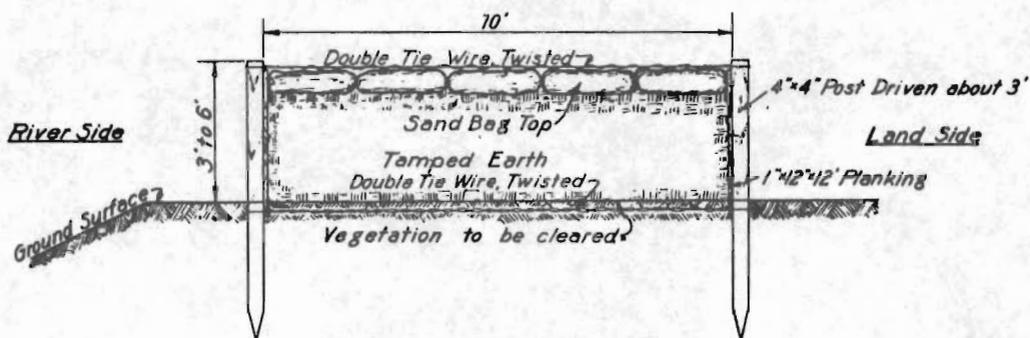
SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

**BRUSHING AND SACKING
THE LANDSIDE SLOPE**

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



PLAN



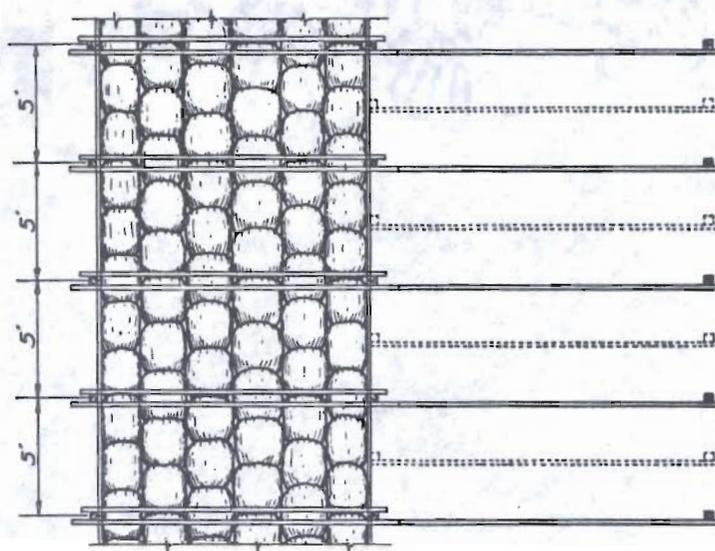
END ELEVATION

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

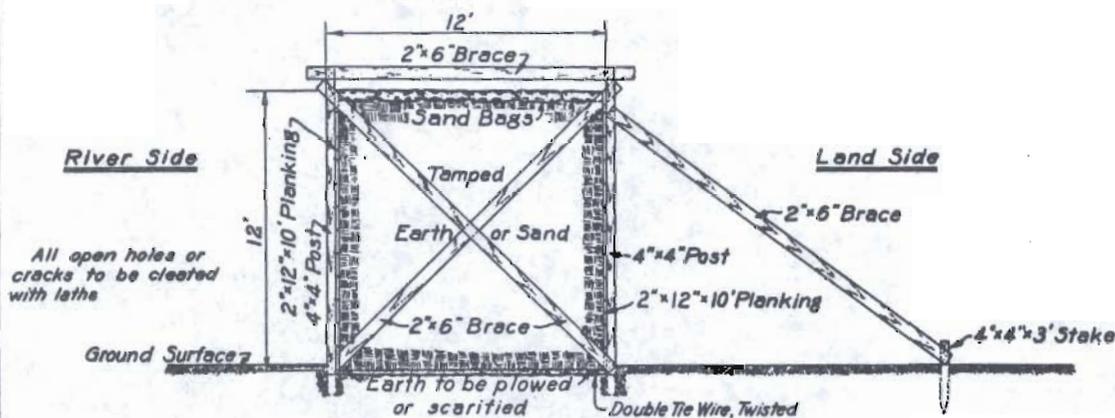
SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

3-6FT. MUD BOX LEVEE
CONSTRUCTION DETAILS

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



PLAN



END ELEVATION

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE			
LUMBER	SAND BAGS	NAILS	EARTH or SAND
40 Posts 4" x 4" x 14'	700	120 lbs. -20d	534 cu. yds.
240 Planks 2" x 12" x 10'		4 lbs. -3d fine	
20 Braces 2" x 6" x 14'		WIRE	
60 Braces 2" x 6" x 18'			20 lbs. #2 gage
* 20 Stakes 4" x 4" x 3'			
5 bundles laths			
Total Lumber 6987 board feet.			

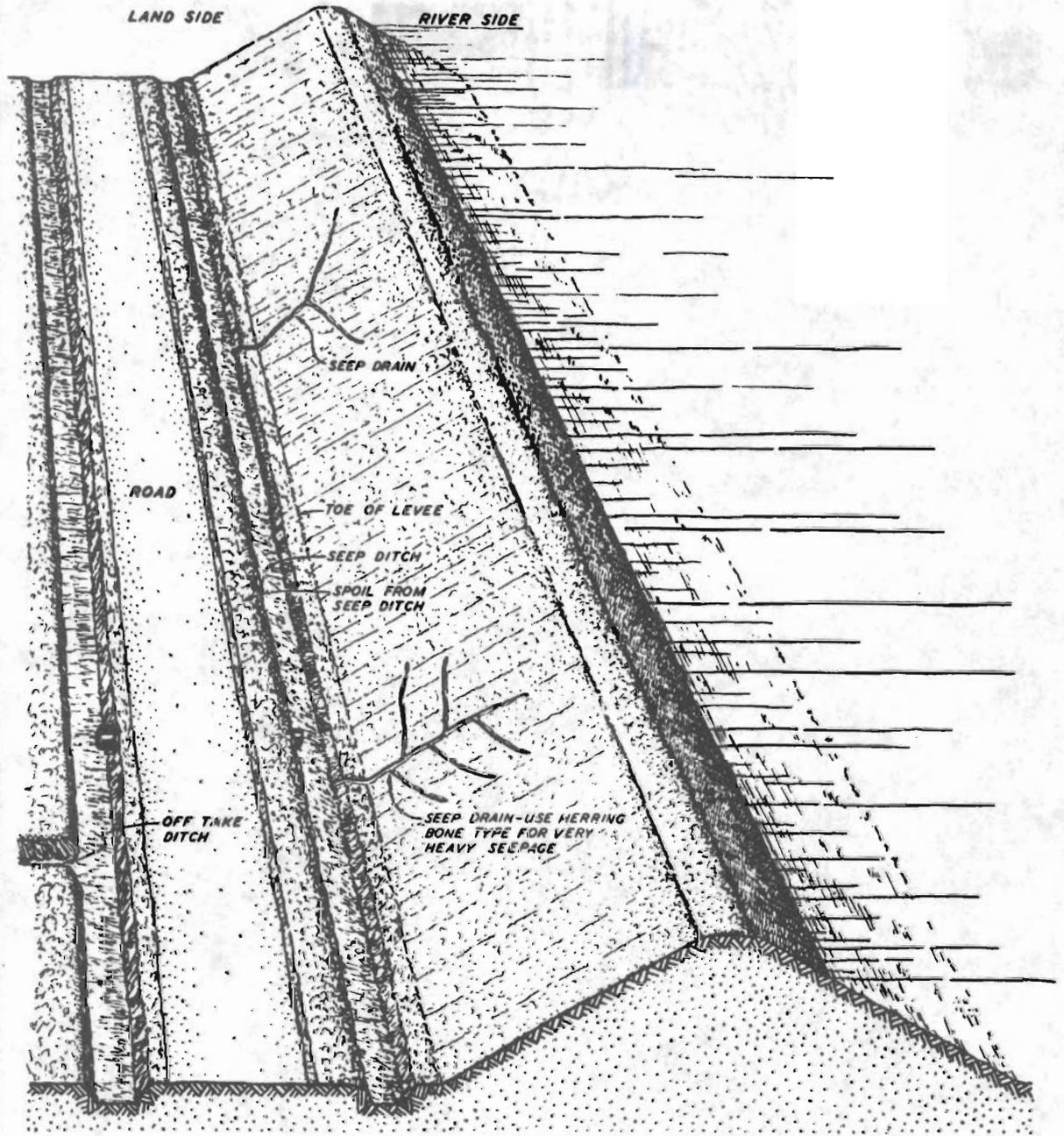
ADDITIONAL MATERIAL FOR BRACING BACK SIDE IN BETWEEN BENTS			
LUMBER	SAND BAGS	NAILS	EARTH or SAND
20 Posts 4" x 4" x 14'		6 lbs. -20d	
20 Braces 2" x 6" x 18'			
* 20 Stakes 4" x 4" x 3'			
Total Lumber 613 board feet.			

* Sharpened

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

MUD BOX BULKHEAD LEVEE
CONSTRUCTION DETAILS

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



SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

**METHOD OF
DRAINING LEVEE SLOPE**

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

CHECK LIST NO. 1

LEVEE INSPECTION REPORT

Date _____

Inspected by _____

Report number of places requiring maintenance work opposite each item listed below. A separate report should be submitted describing the necessary maintenance work for each location.

Reference Manual No. _____

Item No. :	Description	Number of Places
1 :	Settlement, sloughing, or loss of grade	_____
2 :	Caving, (either side of levee)	_____
3 :	Seepage, saturated	_____
4 :	Rip-rap	_____
5 :	Sod	_____
6 :	Access roads and road ramps	_____
7 :	Cattle guards and gates	_____
8 :	Crown of levee	_____
9 :	Unauthorized grazing or traffic	_____
10 :	Unauthorized encroachment on rights-of-way.	_____
11 :	Unauthorized excavation and loose backfill.	_____
12 :	Accumulations of drift, trash or debris	_____
13 :	Weed or undesirable vegetation.	_____
14 :	Miscellaneous pipe crossings.	_____
15 :	Inappropriate burning of grass.	_____
16 :	Other items not included above.	_____

Inspected by _____

EXHIBIT E
CHECK LISTS OF LEVEES,
CHANNEL AND STRUCTURES
(See Supplement Manuals)

EXHIBIT F

LETTER OF ACCEPTANCE

BY STATE RECLAMATION BOARD

(See Supplement Manuals)

EXHIBIT F
Unattached

EXHIBIT G
SUGGESTED SEMI - ANNUAL REPORT FORM
(See Supplement Manuals)

EXHIBIT G
Unattached

November 1953 "Memorandum of Understanding Respecting the Sacramento River Flood Control Project" between the Corps of Engineers and the State

Reclamation Board (Ref. 3). The operation and maintenance regulations are placed in the Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project approved 27 June 1950 (Ref. 4). The State/Federal project legislation is considered to constitute a binding contract between the State and Federal Government for the local cooperation and maintenance responsibilities. The State's authorities and responsibilities for fulfilling operation and maintenance are presented in the State Water Code.

LEEVE MAINTENANCE

1. Transfer of Project Works for Maintenance. - California Debris Commission/Corps of Engineers' construction work on the basic Sacramento River Flood Control Project facilities occurred over 5 decades. Sections of ~~work~~ work were transferred to the Reclamation Board for operation and maintenance as completed. A map showing the general time periods when primary levee construction was completed in various areas and when the levee was

FROM: POLICY PAPER
21 Aug 1987 Scott Morris
Sac River Flood Control System Evaluation
Federal Interest.

~~ined~~ river maintained to sufficient depth for shipping and with high enough summer velocities to keep the mining debris scoured from the channels.

2. Federal Legislation -

A. As a result of the injunctions against hydraulic mining, Congress passed the Caminetti Act creating the California Debris Commission (CDC) on March 1, 1893. Its purpose was to regulate hydraulic mining so that mining might be carried on without injury to navigation and agricultural lands; to improve the navigability of the rivers and to afford relief in flood time. The CDC began surveys of Sacramento Valley streams in July of 1905 and a plan was prepared and submitted to Congress in 1910. The plan consisted of river channels that would carry normal flows, but in the event of a major event, ~~was~~ could overflow the weirs and flow through a system of bypasses and escape without causing major damage. Receiving some modifications in 1913, the plan was authorized as the Flood Control Act of March 1, 1917. It was modified again and extended by the Flood Control Act of 1928. In the original estimates, 90% of all of the levee construction could be done using clamshell dredges. The balance would be done with teams and scrapers.

B. Pursuant to investigations authorized in the Flood Control Act, 22 June 1936, the requirements of local cooperation were reviewed as reported in House Document 205, and as subsequently authorized in the Flood Control Act, 15 August 1941. This Act authorized completion of the project at Federal expense, subject to local interests (a) furnishing all rights-of-way, including railway, highway and all other utility modifications, (b) holding ~~the~~ the U.S. free from damage claims and (c) maintaining and operating all works after completion in accordance with regulations prescribed by the

SACRAMENTO DISTRICT OFFICE ROUTING SLIP

FROM

Civil Design Br.

DATE

10/2/86

DISTRICT ENGINEER	ENGINEERING DIVISION	CONST-OPS DIVISION
DEPUTY DIST ENGR (C)	ASSISTANT	ASSISTANT
DEPUTY DIST ENGR (M)	SPEC ASST TO CHIEF	ADMIN ASST
DEPUTY DIST ENGR (AF)	ADMIN OFFICER	SERVICE BRANCH
EXEC ASST	ADMIN UNIT	MOTOR TRANSPORT OFFICER
SECRETARY	SECRETARY	CONSTRUCTION BRANCH
	PROGRAMS BRANCH	PROJ MANAGEMENT SECTION
VALUE ENGRNG OFCR	CIVIL PROGRAMS SEC	QUALITY ASSURANCE
	MILITARY PROGRAMS SEC	CONTRACT ADMINISTRATION
EEO <input type="checkbox"/> SEPM	PROGRAMS MGT SECTION	PROGRAM & REPORTS
	MILITARY PROJECTS BRANCH	EPA GRANTS BRANCH
ADP CENTER	PROJECT MGT -- AIR FORCE	GRANTS ADMINISTRATION
MICROCOMPUTER TELECOMM	PROJECT MGT -- ARMY	CONSTRUCTION SUPPORT
SYSTEMS & PROG	INSTALLATION SUPPORT	OPERATIONS BRANCH
COMPUTER OPERATIONS	SPECIAL PROJECTS	REGULATORY SECTION
	CONSTRUCTION SUPPORT	SALT LAKE UNIT #3
COUNSEL	A-E NEGOTIATIONS	GRAND JUNCTION #4
	MILITARY DESIGN BRANCH	OPERATIONS & MAINTENANCE
PERSONNEL	MILITARY DESIGN SECTION A	PROJECT OPERATIONS
INCENTIVE AWDS SECRETARY	MILITARY DESIGN SECTION B	BRYTE
	MILITARY DESIGN SECTION C	LOCK
SAFETY	MECHANICAL DESIGN SEC	NAVIGATION & FLOOD CONTROL
	ELECTRICAL DESIGN SEC	NATURAL RESOURCES
PUBLIC AFFAIRS OFFICE	TECHNICAL SUPPORT BRANCH	
	SPECIFICATIONS	LAKES
SECURITY	COST ESTIMATING	BLACK BUTTE
	DOA -- AIR FORCE SECTION	EASTMAN
ADMINISTRATIVE SERVICES	DOA -- ARMY SECTION	ENGLEBRIGHT
LIBRARY	DRAFTING	HENSLEY
GRAPHIC ARTS BRANCH	MAP FILES	ISABELLA
GENERAL SERVICES BRANCH	GEOTECHNICAL BRANCH	MENDOCINO
MAIL ROOM	CONTROL SECTION	NEW HOGAN
TRAVEL	SOIL DESIGN SECTION	PINE FLAT
OFFICE MANAGEMENT BRANCH	GEOLOGY SECTION	SONOMA
HOLD AREA, BRYTE	MATERIALS SECTION	STANISLAUS
OFFICE SUPPLY	SURVEY SECTION	SUCCESS
REPRODUCTION BRANCH	CIVIL DESIGN BRANCH	TERMINUS
WORD PROCESSING CENTER	CIVIL DESIGN SECTION A	
	CIVIL DESIGN SECTION B	RESIDENCES
COMPTROLLER	CIVIL DESIGN SECTION C	MONTEREY
BUDGET BRANCH	CIVIL DESIGN SECTION D	SACRAMENTO
FINANCE & ACCOUNTING BR	UTILITIES	UTAH
EXAMINATION SEC	HYDRAULIC DESIGN	VALLEY
PROPERTY ACCOUNTING SEC	HYDROLOGY	
MANAGEMENT ANALYSIS BR	RESERVOIR CONTROL	SHARPE AREA OFFICE
	PL-99 GROUP	
PROC & SUPPLY DIV		HYDROLOGIC ENGINEERING CENTER
PROCUREMENT BRANCH	PLANNING DIVISION	
CONTRACT SECTION	ASSISTANT	SPD RESIDENT AUDIT OFFICE
PURCHASE SECTION	SPEC ASST TO CHIEF	
SUPPLY BRANCH	SPEC STUDIES UNIT	APOR8/M8-3
CONTRACTS BRANCH	ADMINISTRATIVE ASSISTANT	
SADBU	SECRETARY	USACARA
	SACRAMENTO BASIN BR	
REAL ESTATE DIVISION	COLORADO/GREAT BASIN BR	SPD
ACQUISITION BRANCH	SAN JOAQUIN BASIN BR	
APPRAISAL BRANCH	ECONOMICS BRANCH	SPL
MANAGEMENT & DISPOSAL BR	FLOOD PLAIN MGMT BRANCH	
PLANNING & CONTROL BR	ENVIRON RESOURCES BR	SPN
SPN COORDINATOR		
	EMERGENCY MANAGEMENT DIV	EMPLOYEE COUNCIL

ATTN *John Rompala* FOR ACTN COORD CMT DRFT CIRC SGNR CMT INFO FILE

REMARKS *Attached is the "assurance" for the "Sacramento River Flood Control Project!"*
m Nolan

SACRAMENTO RIVER
FLOOD CONTROL
PROJECT

WAR DEPARTMENT
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON

AIR MAIL

December 22, 1938

Subject: Information on project for control of floods,
removal of debris, and improvement of Sacramento
River, California.

To: The Division Engineer
South Pacific Division
414 Custom house,
San Francisco, California

1. Confidential information received from the Bureau of the Budget indicates that the Department's recent estimate of \$1,754,400 for Flood control, Sacramento River, has been disallowed in the estimate approved by the President. The Bureau of the Budget has advised this office that suitable estimates for work on this project may be included in a Deficiency Bill during the coming session of Congress, when the provisions of the river and harbor act approved August 26, 1937, providing that the State of California shall assure by appropriate legislation the maintenance of the remainder of the project and shall assume certain other required conditions of local cooperation, have been met.

2. In order that the Chief of Engineers may have full information concerning this project and the possibility of the State of California enacting the necessary legislation, it is desired that a memorandum be forwarded to this office not later than January 10, 1939, outlining briefly the progress to date of the project, the status of legislation and any other items that might be of interest to members of the Appropriations Committee in their consideration of the advisability of including funds for flood control on the Sacramento River in the regular War Department Civil Appropriation bill.

By direction of the Chief of Engineers:

J. C. Marshall,
Captain, Corps of Engineers,
Assistant Chief, River and Harbor Section.

311/643

Subject: Information on project for control of
floods, removal of debris, and improve-
ment of Sacramento River, California.

Office, Division Engineer, South Pacific Division, San Francisco, Calif.
December 24, 1938. To the DISTRICT ENGINEER, SACRAMENTO, CALIF.

For his information and prompt investigation and report. Reply
should reach this office not later than January 5, 1939.

RED'D DEC 27, 1938
SACTO, CALIF

WARREN T. HANNUM,
Colonel, Corps of Engineers,
Division Engineer.

OCS-HM/EMM

662.2(FC)1-17

2nd Ind.

U.S. Engineer Office, 208 Post Office Bldg., Sacramento, Calif. December 29, 1938.-
To the Division Engineer, South Pacific Division, SAN FRANCISCO, CALIF.

1. The Sacramento River Flood Control Project is approximately 79 per cent completed. The two cut-offs and the five weirs have been completed, along with the project outfall gates; the channel enlargement dredging is 99 per cent completed and the levees of the 1928 project are 66 per cent completed. The California Legislature has not been in regular session since August 26, 1937, the date the revision of the project was adopted by the Federal Government. Reclamation interests are preparing to present a bill in the State Legislature at its session which begins in January which would adopt the provisions of the revised project. They state they know of no particular opposition to the passage of the bill.

2. Regarding the department's recent estimate of \$1,754,400 additional federal funds needed for flood control, Sacramento River, as shown in the approved draft of the "Proposed operations" for this project for the fiscal year 1940, it should be noted that the sum of \$1,254,400 is to be applied as the federal portion of the cost of construction of new levees and raising old levees to grade and cross-section, that were included in the project adopted May 15, 1928, and that the sum of \$103,000 is for necessary maintenance work. This \$1,254,400 fund for the construction of levees under the old project will require a like amount of state funds, which is included in the appropriation state authorities are to request from the next State Legislature. Only \$397,000 of federal funds are allocated to the reconstruction of levees and bank protection works authorized under the revised project adopted by the River and Harbor Act of August 26, 1937, by the terms of which act certain additional local cooperation is required.

3, It was known when the original draft of "Proposed operations" was prepared last April that, if funds expended for maintenance were to be included, the amount remaining under the \$17,600,000 limitation was insufficient to complete the items of work authorized by the Act of May 15, 1928 (See my letter of July 27, 1938, on subject "Annual Report", my file 111 - GEN -2). Of the \$17,600,000 only the sum of \$98,325.85 remains unappropriated (See 1st Ind. of April 9, 1937, E.D. 7402 - Sacramento R. - 310). To November 30, 1938, the cost to the United States of work items actually charged out as maintenance had been \$758,164.98. In addition the Federal Government's portion of the cost of bank protection work had been approximately \$600,000. This bank protection work, in accordance with instructions from the Chief of Engineers, has been charged out as new work, although it is authorized in the project document as a matter of maintenance - total maintenance costs being set at \$100,000 per annum except in years of unusually high water. Neither the cost of bank protection work nor any other maintenance item is included in the estimate of cost in the project document making up the \$17,600,000 to which figure Congress apparently intended to limit the expenditures for new work. In other words, a total apparent deficit of \$1,358,164.98 has really been caused by charging maintenance items against the estimate for new work.

4. It is therefore strongly urged that every effort be exerted to have restored to the budget at least the amount of \$1,357,400 of federal funds for this project for the fiscal year 1940 for the completion of levees authorized under the old project and for maintenance. The balance of \$397,000 could be included in a deficiency bill when the State Legislature has enacted the appropriate laws. For the economical prosecution of levee building on this project funds therefor should be available by May 1st in order that the work may be advertised, contracts made and construction actually started by about July 1st. This program gives the contractor some $4\frac{1}{2}$ to 5 months of good weather to finish the work. Any later commencement means that the work must be unduly rushed, or that it must be shut down during the winter months and completed the next season.

5. It is requested that this office be kept advised as to the status of this matter in order that plans for next season's work may be made to accord thereto.

Dispatched Dec. 29, 1938
EMM

L. B. CHAMBERS
Colonel, Corps of Engineers,
District Engineer

AIR MAIL

311/643

Subject: Information on project for control of floods, removal of debris, and improvement of Sacramento River, California.

3rd Ind.

Office, Division Engineer, So. Pac. Division, San Francisco, Jan. 11, 1939.
To: The Chief of Engineers, U. S. Army, WASHINGTON, D. C.

1. It is desirable that the fullest practicable consideration be given to the points raised in the basic letter, in order to insure, if possible, the orderly and necessary completion of this important project at the earliest practicable date.

2. However, reference in connection with the above is made to 2nd Indorsement, Office, Chief, of Engineers, October 23, 1936 Subject: Method of Charging Bank Protection Work, E. D. File 7402 (Sacramento R) 289. In that Indorsement, the legal limitation of Federal funds (\$17,600,000) applied to Sacramento River flood control was interpreted to include maintenance as well as new work. Under this interpretation the arguments in paragraph 3, 2nd Indorsement thereof, do not apply, and it appears that additional substantial funds may not be applied to the project until the local cooperation required by the Act approved August 20, 1937, shall have been complied with.

REC'D JAN 12, 1939
SACTO, CALIF

WARREN T. HENNUM,
Colonel, Corps of Engineers
Division Engineer.

cc: Sacramento District

7402 (Sacramento River)-#71

Subject: Information on project for control of floods, removal of debris, and improvement of Sacramento River, Ca.

4th Ind.

3-E

Office, C. of E., January 20, 1939, To the Division Engineer, South Pacific Division, San Francisco, Calif.

The Department should be promptly advised when the conditions of local co-operation have been met, at which time effort will be made to secure the necessary funds.

By direction of the Chief of Engineers:

MILES REBER,
Captain, Corps of Engineers,
Assistant Chief, River and Harbor Section.

311/643

5th Ind.

Office, Division Engineer, So. Pac. Division, San Francisco, Jan 26, 1939.
To: District Engineer, U. S. Engineer Office, SACRAMENTO, CALIFORNIA.

For notation and compliance.

REC'D JAN 27, 1939
SACTO, CALIF.

WARREN T. HANNUM,
Colonel, Corps of Engineers,
Division Engineer.

7402 (Sacramento River)-471

Subject: Information on project for control of floods, removal of debris, and improvement of Sacramento River, Calif.

662.2(FC)1-17

6th Ind.

OGS/EMM

U. S. Engineer Office, 208 Post Office Bldg., Sacramento, Calif., Feb. 7, 1939. -
To the Division Engineer, South Pacific Division, SAN FRANCISCO, CALIF.

1. There are inclosed herewith two copies of Senate Bill No. 950 as presented in the first session of the California Legislature in January covering state participation, etc., in the Sacramento River Flood Control Project. The bill is for compliance with the conditions imposed in Senate Committee Print, 75th Congress, 1st Session "that the State of California shall assure by appropriate legislation the maintenance of the remainder of the project, shall hold and save the United States from damages due to construction works."

2. Two conference have been had with state officials on the subject. They state that in formulating this law they have attempted to hold to the principle expounded in Senate Document No. 23, 69th Congress, 1st Session, in regard to maintenance "that responsibility for maintenance of each part of the project should rest upon the party most directly interested in its maintenance." The bill endeavors to definitely place the responsibility for all maintenance features. This office concludes that in general the legislation will accomplish the desired purpose with certain minor changes being advisable. Comments and suggestions in regard thereto are as follows:

a. Section 1. To fully and definitely cover the intended purpose the section should read:

"The conditions, plan, construction and mode of maintenance and operation of works within the Sacramento River Flood Control Project set forth in Senate Committee Print, 75th Congress, 1st Session: as authorized and approved by act of Congress, Public No. 392, 75th Congress, approved August 26, 1937, is hereby approved and adopted by and on behalf of the State of California and the Department of Public Works, acting by and through the State Engineer, is authorized and empowered to expend, or contribute to the United States funds, herein appropriated or otherwise available for such purposes, to provide all lands, easements, and rights-of-way for bank revetment for the protection of levees above Cache Slough and the levee reconstruction, including the cost of all alterations to highways, road crossings, and drainage and irrigation facilities incident to the work and the State's contribution of one-third of the cost of bank revetment and levee construction, as provided for and required under the provisions of said act of Congress."

b. Section 2 provides for maintenance by the state itself of certain parts of the flood control project over which no other regularly organized agency has jurisdiction or responsibility. The law referred to in sub-section (1) is Senate Bill No. 697, Chapter 597, two copies of which are inclosed herewith. The law referred to in sub-section (2) is given on pages 27 and 28 of the pamphlet entitled "Sacramento and San Joaquin Drainage District Refunding Act, Reclamation Board Act and Reclamation Board Bond Act of the State of California," two copies of which are also inclosed. However, for the sake of clarity and definiteness, it is suggested that the sub-section be changed to read merely "All weirs and relief structures." Sub-section (3) covers a piece of levee just recently completed by state and federal funds over which no local agency has jurisdiction. A careful check is being made of all the levees built under this project with joint funds as regards their relationship to district boundaries, etc. It may show the necessity of adding other new stretches of levee to this sub-section. Also, as levees are completed in the future it may be necessary to have some of them included in this provision for maintenance by the state. However, the final clause of the subsection reading "after completion and acceptance by the state of the levee for such maintenance and operation," should be eliminated so the State Engineer would have authority to do necessary maintenance on the partially completed levee. Also, a fourth sub-section should be added to read about as follows:

"(4) Any other levee which may be constructed jointly from state and federal funds over which no other state agency has jurisdiction or responsibility."

The purpose of this sub-section is to insure maintenance of all levees from the time of their construction. Without some such provision some levee may be built for which the state must assume the maintenance but which, without some such provision, the State Engineer would be without authority to maintain until definitely included in the program at the next meeting of the legislature. This is of especial importance in view of the fact that the California State Legislature meets only every two years.

c. For clarity and to more definitely set forth its purpose, Section 3 should be corrected to read as follows: "It is and shall be the responsibility, liability and duty of the reclamation districts, levee districts, protection districts, drainage districts, municipalities, and other public agencies within the Sacramento River Flood Control Project, to maintain and operate the works of said project within the boundaries or jurisdiction of such agencies, excepting only those works enumerated in Section 2 hereof or for which provision is made by federal law."

d. To make the whole act more effective as far as jurisdiction by the State Engineer is concerned, and to insure proper and adequate inspection of levees, etc., the following should be added to Section 4: "It shall be the duty of, and the governing bodies of all state agencies, enumerated in Section 3 hereof, shall, on or before June 1st of each year after the effective date hereof, cause a report or reports on the condition of the Sacramento River Flood Control Project works within the jurisdiction of each respective agency prepared and submitted by a competent civil engineer, registered in accordance with law. Such report or reports shall contain a detailed statement of the conditions of said flood control works, the maintenance and operation thereof, and the work necessary to properly maintain and operate said works for the succeeding year with an estimate of the cost thereof and such other recommendations as may seem proper to insure the safety of said project works. A certified copy of said report shall be filed with the State Engineer the following July 1st, and the original of said report shall be filed in the office of the respective governing bodies and shall be open to public inspection."

3. The state officials at the conference expressed agreement with the proposed changes and additions, and, if satisfactory to the department, will have the bill amended to accord therewith at the second session of the legislature which convenes March 6th. They express confidence in being able to get it enacted if substantially in this shape. It is therefore recommended that the bill, with suggestions and corrections indicated above, be accepted by the department as satisfactorily meeting the requirements of the federal law pertaining to this project.

3 Incls

Senate Bill No. 950
Senate Bill No. 697
Sacramento And San Joaquin
Drainage District Refunding
Act," etc.(all in dup.)

L. B. CHAMBERS,
Colonel, Corps of Engineers,
District Engineer.

(Copy of 6th Ind., with Inclosures, via
Air Mail to Colonel Warren T. Hannum,
c/o Army and Navy Club, Washington, D.C.)

311/643

REC'D MAR 14, 1939
SACTO, CALIF.

Subject: Information on the project for control of floods, removal of debris and improvement of Sacramento River, California.

7th Ind.

Office, Division Engineer, So. Pacific Division, San Francisco, Feb. 10, 1939
To: The Chief of Engineers, U. S. Army, WASHINGTON, D. C.

The Division Engineer concurs in the views and recommendations of the district engineer subject to changes as follows:

(a) In order definitely to provide for saving the United States from claims for damages, Section 1 should read as follows:

"Section 1. The conditions, plans, construction, and mode of maintenance and operation of works within the Sacramento River Flood Control Project set forth in Senate Committee Print, 75th Congress, 1st Session, as authorized and approved by Act of Congress, Public No. 392, 75th Congress, approved August 26, 1937, including the holding and saving of the United States from damages due to construction works, are hereby approved and adopted by and on behalf of the State of California, and the Department of Public Works, acting by and through the State Engineer, is authorized and empowered to contribute funds to the United States and to expend funds herein appropriated or otherwise available for such purposes, to provide all lands, easements and rights-of-way for bank revetment for the protection of levees above Cache Slough, and the levee reconstruction, including the costs of all alterations to highways, road crossings, and drainage and irrigation facilities incident to the work and the State's contribution of one-third of the costs of bank revetment and levees construction, as provided for and required under the provisions of said Act of Congress."

(b) Reference Paragraph 2 - Item C1

Line 6 - The work "limits" should be added after the work "project".

Line 9 - The words "for maintenance and operation" should be added after the word "provision".

The following matter should be substituted for Paragraph 2(d) as carried in the 6th Indorsement in the interests of clarification:

"2d. To make the whole act more effective as far as jurisdiction by the State Engineer is concerned, and to insure proper and adequate inspection of levees, etc., the following should be added to Section 4: 'It shall be the duty of the governing bodies of all state agencies enumerated in Section 3 hereof to make annual reports

as follows: - said governing bodies shall on or before June 1st of each year after the effective date hereof; cause a report or reports on the condition of the Sacramento River Flood Control Project works within the jurisdiction of each respective agency, to be prepared and submitted by a competent civil engineer registered in accordance with law. Such report or reports shall contain a detailed statement of the condition of said flood control works as of May 1st, the maintenance and operations thereof for the reported year, and the work necessary to properly maintain and operate said works for the succeeding year with an estimate of the cost thereof, and such other recommendations as are deemed necessary to insure the safety of the project works. A certified copy of said report or reports shall be filed with the State Engineer the following July 1st, and the originals of said reports shall be filed in the offices of the respective governing bodies and shall be open to public inspection".

WARREN T. HANNUM,
Colonel, Corps of Engineers,
Division Engineer.

REC'D MAR 14, 1939
SACTO, CALIF

VIA AIR MAIL

7402(Sacramento River)471

5-A

Subject: Information on project for control of floods, removal of debris, and improvement of Sacramento River, Calif.

8th Ind.

Office, C. Of E., February 20, 1939 - To the Division Engineer,
South Pacific Division, San Francisco, Calif.

It is the view of this office that Senate Bill No. 950, as amended by the District Engineer, and as further amended by the Division Engineer, will, when enacted, satisfactorily provide for the fulfillment of the requirements of local cooperation set forth in Senate Committee Print, Seventy-fifth Congress, First Session.

By direction of the Chief of Engineers:

J. C. MARSHALL,
Captain, Corps of Engineers,
Acting Chief, River and Harbor Section

311/643

9th Ind.

Office, Division Engineer, So. Pac. Division, San Francisco, Feb. 27, 1939.
To: The District Engineer, U. S. Engineer Office, SACRAMENTO, CALIF.

1. To note.

2. The desired changes in Senate Bill No. 950 should be brought to the attention of the State officials with a view toward having the revisions made therein.

WARREN T. HANNUM,
Colonel, Corps of Engineers
Division Engineer.

REC'D FEB 28, 1939
SACTO., CALIF.

7402 (Sacramento River) 471

SUBJECT: Information on project for control of floods, removal of debris and improvement of Sacramento River, California.

662.2(FC)1-17

10th Ind.

IMW

U. S. Engineer Office, 208 Post Office Building, Sacramento, California. March 11, 1939. To the Chief of Engineers, U. S. Army, Washington, D. C. (Through the Div. Engineer, South Pacific Division, 414 Customhouse, SAN FRANCISCO, CALIF.)

Inclosed is Senate Bill No..950, amended in the State Senate March 9, 1939. This amended bill includes all of the changes suggested in 6th and 7th indorsements to basic communications

1 Incl.
Sen. Bill. 950.
(in sext.)

L. B. CHAMBERS,
Colonel, Corps of Engineers,
District Engineer.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SACRAMENTO

June 26, 1939

Col. L. B. Chambers
U. S. Engineers Office
Post Office Building
Sacramento, California

Dear Colonel Chambers:

Enclosed herewith is a certified copy of Chapter 656, Statutes of 1939. As you will note, no change has been made in the bill since it was approved by your office.

Very truly yours,

/s/ Edward Hyatt
State Engineer

Enclosure

Senate Bill No. 950.

Passed the Senate May 8, 1939.

J. A. BEEK

Secretary of the Senate

Passed the Assembly June 19, 1939.

JACK CARL GREENBURG

Chief Clerk of the Assembly

This bill was received by the Governor this 20th

day of June, 1939, at 4 o'clock P. M.

CULBERT L. OLSON

Private Secretary of the Governor

CHAPTER 656

An act relating to the maintenance and operation of the Sacramento River Flood Control Project, approving and adopting an act of Congress, Public No. 392, 75th Congress, approved August 26, 1937; prescribing the duties and obligations of political subdivisions and agencies of the State in the maintenance and operation of the works of the Sacramento River Flood Control Project; authorizing and directing the State Department of Public Works to perform certain duties or obligations of the State and to supervise those of political subdivisions and agencies in the maintenance and operation of the works of the Sacramento River Flood Control Project; providing an appropriation therefor; declaring the urgency thereof and providing that this act shall take effect immediately.

The people of the State of California do enact as follows:

SECTION 1. The conditions, plans, construction, and mode of maintenance and operation of works within the Sacramento River Flood Control Project, set forth in Senate Committee Print, 75th Congress, 1st Session, as authorized and approved by act of Congress, Public No. 392, 75th Congress, approved August 26, 1937, including the holding and saving the United States from damages due to construction works, are hereby approved and adopted by and on behalf of the State of California and the Department of Public Works, acting by and through the State Engineer, is authorized and empowered to contribute funds to the United States and to expend funds herein appropriated or otherwise available for such purposes, to provide all lands, easements, and rights of way for bank revetment for the protection of levees above Cache Slough and the levee reconstruction, including the costs of all alterations to highways, road crossings, and drainage and irrigation facilities incident to the work and the State's contribution of one-third of the costs of bank revetment and levee construction, as provided for and required under the provisions of said act of Congress.

SEC. 2. The Department of Public Works, acting by and through the State Engineer, shall have jurisdiction over and is authorized and directed to maintain and operate on behalf of the State of California the following units or portions of the works of the Sacramento River Flood Control Project.

and the cost of such maintenance and operation shall be defrayed by the State:

(1) Those units or portions described in section 2 of the Sacramento and San Joaquin Drainage District Refunding Act, Statutes of 1927, page 1503, as amended.

(2) All weirs and relief structures.

(3) The west levee of the Yolo Bypass, extending from the west end of the Fremont Weir southerly a distance of about two miles to the northerly levee of the Knights' Landing Ridge Cut.

(4) Any other levee which may be constructed jointly from State and Federal funds over which no other State agency has jurisdiction or responsibility after a written finding by the State Engineer that such levee is within the provisions of this subsection. Upon written notice from the United States of the construction of any such levee, it shall be the duty of the State Engineer promptly to make his finding thereon.

SEC. 3. It is and shall be the responsibility, liability and duty of the reclamation districts, levee districts, protection districts, drainage districts, municipalities, and other public agencies within the Sacramento River Flood Control Project limits, to maintain and operate the works of said project within the boundaries or jurisdiction of such agencies, excepting only those works enumerated in section 2 hereof or for which provision for maintenance and operation is made by Federal law.

SEC. 4. On behalf of the State of California, the Department of Public Works, acting by and through the State Engineer, shall have supervisory powers over the maintenance and operation of the flood control works of said Sacramento River Flood Control Project.

It shall be the duty of the governing bodies of all State agencies enumerated in section 3 hereof to make annual reports as follows: Said governing bodies shall on or before June 1st of each year after the effective date hereof cause a report or reports on the condition of the Sacramento River Flood Control Project works within the jurisdiction of each respective agency, to be prepared and submitted by a competent civil engineer registered in accordance with law. Such report or reports shall contain detailed statements of (1) the condition of said flood control works as of May 1st of that year, (2) the record of maintenance and operation of said works for the preceding year, (3) the work necessary to properly maintain and operate said works for the succeeding year with an estimate of the cost thereof, and (4) such other recommendations as are deemed necessary to insure the safety of the project works. A certified copy of said report or reports shall be filed with the State Engineer on or before the follow-

CRB/ah

PSKHA 800.06 (Sec R.
Minor Tributaries)

31 March 1948

The Reclamation Board
State of California
1100 "O" Street
Sacramento 14, California

Gentlemen:

Reference is made to letters from your office dated 22 December 1947 and 4 March 1948 relative to submittal of additional assurances on the work proposed for certain "Minor Tributaries" of the Sacramento River.

In accordance with authority received from Office, Chief of Engineers, dated 22 March 1948, you are hereby notified that additional assurances are not required for the proposed work.

Sincerely yours,

JOSEPH S. GORLINSKI
Colonel, Corps of Engineers
District Engineer

cc: C.R.R. - w/d
Engr. Divn.
Constr. Divn.
R.E. Divn.

com
[Signature]
EAB

Subject: Assurances Sacramento River
Flood Control Project
(Basic: 10 March 1948)

PSDVL 800.06 (Sacto River,
Calif) Sac Dist

1st Ind

South Pacific Division, Corps of Engineers, Oakland Army Base,
Oakland 14, California, 15 March 1948

To: Chief of Engineers, Department of the Army, Washington 25, D. C.

I am satisfied with the analysis made by the Attorney General of the State of California and with his conclusion as to the need for further assurances from the State of California on the enlarged Sacramento River Flood Control Project. I therefore concur in the request of the District Engineer that authority be granted to notify the State formally that additional assurances will not be required.

4 Incls
w/d - 1 cy ea



DWIGHT F. JOHNS
Colonel, CE
Division Engineer

cc
Sacramento District

20674

601.1 Sacramento River, California - ENGLP
(State of California Board of Reclamation).

Basis 3/13/48

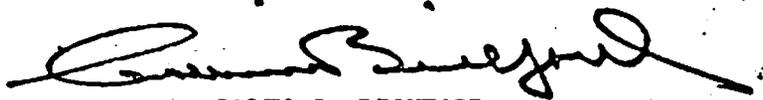
2d Ind.

Office, Chief of Engineers, Washington, D. C., 22 March 1948

TO: The Division Engineer, South Pacific Division, Corps of Engineers,
OAKLAND, CALIFORNIA.

It is the view of this office that additional assurances of cooperation are not required. Authority is granted to notify the Reclamation Board, State of California, that additional assurances are not required for the proposed improvement of the Sacramento River.

BY ORDER OF THE CHIEF OF ENGINEERS:



COLIN C. BICKFORD
Assistant, Acquisition Division
Real Estate

Incls: w/d

Subject: Assurances Sacramento River
Flood Control Project
(Basic: 10 March 1948)

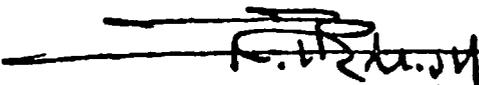
PSDVL 800.06 (Sacramento
River, Calif) Sac Dist 3rd Ind

South Pacific Division, Corps of Engineers, Oakland Army Base,
Oakland 14, California, 26 March 1948

To: District Engineer, Sac Dist, Corps of Engrs, Sacramento, Calif

Directing attention to the preceding indorsement.

BY ORDER OF THE DIVISION ENGINEER:


R. H. ELLIOTT
Colonel, CE
Executive

*see
hand
clon
for
file
file
file*



800.06 (SAC. RIV. CALIF.)

ADDRESS REPLY TO
DISTRICT ENGINEER
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
P. O. BOX 1739
SACRAMENTO 8, CALIFORNIA

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER
SACRAMENTO DISTRICT
WRIGHT BLDG 1200 8TH ST
SACRAMENTO, CALIFORNIA

REFER TO FILE NO PSYKA 800.06 (Sac.R.)

10 March 1948

SUBJECT: Assurances Sacramento River Flood Control Project

THRU: The Division Engineer
South Pacific Division
Corps of Engrs., Dept. of the Army
Oakland Army Base
Oakland 14, California

TO: The Chief of Engineers
Department of the Army
Washington 25, D. C.

1. Attention is invited to the inclosed copies of correspondence relative to assurances for the Sacramento River Flood Control Project which was authorized by Section 10 of the Flood Control Act approved 22 December 1914, (Public Law 534 - 78th Congress, Chapter 665 - 2nd Session) in accordance with House Document 649, 78th Congress 2nd Session.

^{2.1}
2. In accordance with Chapters 5209.01 and 5209.02, O & R, by letter dated 22 August 1947, this office requested the Reclamation Board, State of California, to furnish local assurances required for the project. The opinion of the Attorney General, State of California, submitted by letter dated 4 March 1948 indicates that previous assurances are to be construed to include the additional work.

^{2.2}
3. After due consideration and study of the situation as covered by the various acts of Congress referred to in the inclosed correspondence this office concurs in the opinion of the Attorney General, State of California, that existing assurances are sufficient to include the additional work. It is, therefore, requested that authority be granted to issue formal notification to the State of California that additional assurances are not required.

4 Incls.

1. Cy ltr dtd 8-22-47 (trip) line 1
2. Cy ltr dtd 12-22-47 (trip) - 2
3. Cy ltr dtd 12-30-47 (trip) - 2.1
4. Cy ltr dtd 3-4-48 & Incl

Joseph A. K... ..
JOSEPH B. GORLINSKI
Colonel, Corps of Engineers
District Engineer.

ANALYSIS

The Sacramento River Flood Control Project is a cooperative project between the State and the Federal Government which has been in existence since 1917. The plan of cooperation now in effect, pursuant to Federal law, is that so far as levee and by-pass systems are concerned, the Federal Government pays all designing and construction costs while the State must provide the necessary easements and rights of way and furnish assurances satisfactory to the Secretary of War that the State will maintain the project and will hold the United States harmless from all claims due to the construction of the project.

While, for a time after the commencement of the project, the State itself or local interests were required to furnish portions of the construction cost, such is not now the case.

The basic flood control project is set forth in what is known as the Grant Report, that is, Senate Document 23 - 69th Congress, First Session. The project as contained in this report sets forth the obligations of the State. The project containing these requirements upon the State was approved by the Legislature of California in 1925 (Stats. 1925, Chap. 176, now codified as Section 8525 of the Water Code). The Grant Report made it very clear that modifications and step by step construction of the entire project were to be made. (See pages 7, 8, 11, and 18 of Senate Document 23.)

In 1937 Congress by Public Law 392, 75th Congress, approved the Senate Committee Print and in 1939 the California Legislature by Chapter 656 approved the project as modified by this document. Under this legislation the obligations of the State were substantially the same as now required in connection with the minor tributary work. This approval was reenacted in 1943 by the addition of section 8350 to the Water Code.

In the Flood Control Act of 1944, House Document 649 was approved by Congress as further continuations and modifications of the Sacramento River Flood Control Project, and we find in this document the specific items of work to be performed on the minor tributaries. By Chapter 1514, Statutes of 1945 (Deering's General Laws, Act 9178f, section 31), the additions to and modifications of the original flood control project are again approved subject to a special provision as to one phase of the project which is not involved here.

While section 42 of the 1945 California act provides that assurances satisfactory to the Secretary of War as to State cooperation shall be given by The Reclamation Board, it is to be noted that section 24 of the act reads in part as follows:

"It is expressly declared that it is the intention of the Legislature that nothing in this act shall be deemed to change the policy of the State respecting that certain contract entered into between the Federal Government and the State of California made pursuant to an act of Congress of the United States, approved May 15, 1928 (Public Numbered 391, Seventy-seventh Congress, first session, 45 Statutes at Large 534, Chapter 569), and an act of the Legislature, approved May 4, 1925, (Chapter 176, Statutes of 1925, Section 8525, Water Code), . . ."

It seems to us that the legislative history of the adoption and approval of the project which carries with it the obligations to be assumed by the State, first in 1925, and as modified in 1939 and in 1945, evidences a clear assumption by the State of the obligations imposed on it without the necessity of The Reclamation Board executing additional assurances. There is no doubt but that the minor tributaries work is a part of the project referred to in these statutes. The reciprocal legislation above referred to has always been considered to constitute a binding contract upon the State and Federal Government, and the Secretary of War has not required the execution by any State officers or bodies of documentary assurances. We see no reason why any different view should be taken of the minor tributary work.

* * * * *



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER
SACRAMENTO DISTRICT
WRIGHT BLDG. 1209-8TH ST
SACRAMENTO, CALIFORNIA

PLEASE REPLY TO
DISTRICT ENGINEER
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
P. O. BOX 1738
SACRAMENTO 8, CALIFORNIA

AUG 3 1949

REFER TO FILE NO PSKGC 800.5(Sac.R. FC Proj)

SUBJECT: Operation and Maintenance Manuals, Sacramento River Flood Control Project

TO: The Division Engineer
South Pacific Division
Corps of Engrs., U. S. Army
Oakland 14, California

1. Reference is made to the Sacramento River Flood Control Project, adopted by the Flood Control Act of 1 March 1917, Public 367, 64th Congress (House Document 81, 62nd Congress, 1st Session), and to subsequent modifications. Further reference is made to paragraph 4221.05a, Orders and Regulations, which requires the preparation of Operation and Maintenance Manuals for each project or separate useful part thereof to assist responsible authorities in carrying out their obligation as specified by law.

2. In compliance with the above, a Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project was prepared and submitted by our letter dated 7 January 1948. Approval of this manual was contained in Chief of Engineers 2nd Indorsement dated 28 April 1948. Copies of the approved manual have been furnished local interests in accordance with instructions contained in paragraph 4221.02b, Orders and Regulations.

3. The Department of Public Works of the State of California, under the provisions of sections 8360 to 8447 of the Water Code of the State, is delegated certain powers in connection with the maintenance and the operation of the Sacramento River Flood Control Project. That Department, in accordance with the code, maintains and operates at State expense certain units or portions of the project and supervises the maintenance and operation of other units of the project which are the obligation of local reclamation, drainage, or levee districts and Counties and Municipalities. In all cases, the Department is obligated to comply or secure compliance with Federal Regulations.

4. Section 208.10, Title 33 of the Code of Regulations is quoted in the manual and contains regulations for the operation and maintenance

824.3 (SAC. RIV. FC. PROJ) BOX 20

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PSKGC 800.5(Sac.R. FC Proj)

Subject: Operation and Maintenance Manuals, Sacramento River Flood Control Project

of local flood protection works approved by the Secretary of War, in accordance with the authority contained in Section 3 of the Flood Control Act of 22 July 1936, as amended and supplemented. These regulations, as written, apply to flood control projects throughout the nation and are of necessity general in character.

5. The Department of Public Works of the State of California contend that some of the requirements contained in paragraph 208.10b (1) MAINTENANCE, are not applicable to this part of the United States. Climatic conditions are such that the growth of sod on the levee slopes is impracticable. They further contend that due to the nature of levee growth, the burning of weeds and brush during appropriate seasons should be accomplished in order to determine damage to the levee such as slips and cracks and to permit the detection of holes caused by burrowing animals.

6. Since this contention is concurred in by this District, it is requested that under the provisions of paragraph 4221.03a of the Orders and Regulations that the code of Federal Regulations be revised, insofar as the Sacramento River Flood Control Project is concerned, to read as follows:

"(b) Levees — (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structure at the time of floods. Measures shall be taken to exterminate burrowing animals and provide for clearing of brush, trees, and other wild growth from the levee crown and slopes. Brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash. Where practicable, measures shall be taken to retard bank erosion by the planting of willows or other suitable growths 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 change.
- (ii) No change.
- (iii) No change.
- (iv) No change.
- (v) No change.

PSKGC 800.5(Sac.R. FC Proj)

Subject: Operation and Maintenance Manuals, Sacramento River Flood Control Project

(vi) No change.

(vii) Weeds, grasses and debris on the levee are 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 peat levees or where burning would constitute a hazard.

(viii) No change.

(ix) No change.

(x) No change.

(xi) No change.

(xii) No change."

7. Subsequent to the approval of the recommended change in Title 33, this office will revise the Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project in order that it will be in agreement with the changes recommended herein.

cc: State Div. of
Water Resources
State Recl. Bd.



Subject: Operation and Maintenance
Manuals, Sacramento River
Flood Control Project
(basic: 3 August 1949)

PSDGW 800.21(Sacramento River,
Calif) Sac Dist

1st Ind

(S-8 September 1949)

South Pacific Division, Corps of Engineers, US Army, Oakland Army Base,
Oakland 14, California, 8 August 1949

To: Chief of Engineers, Department of the Army, Washington 25, D C

Concurring in the request of the District Engineer.

FOR THE DIVISION ENGINEER:



OWEN G. STANLEY
Chief, Engineering Division

ENGWFO

Subject: Operation and Maintenance Manuals,
Sacramento River Flood Control Project
(Ltr Sac Dist to SPD 3 Aug 49)

2d Ind.

Office of the Chief of Engineers, Washington 25, D. C., 17 November 1949

TO: The Division Engineer, South Pacific Division, Corps of Engineers,
OAKLAND, CALIFORNIA

1. Review of the application of the general regulations governing the maintenance and operation of flood control works as prescribed in 1944 and supplemented by manuals to assist local interests in carrying out their obligations thereunder has disclosed no need for amending them in any respect. It is considered undesirable to modify these general regulations as proposed in basic letter to meet a condition peculiar to one area. In lieu of any such amendment the purpose thereof can be accomplished by revising and including in the operation and maintenance manual for the Sacramento River flood control project an appropriate statement to the effect that, since the growth of soil on the slopes of the levees of this project is not practicable and as the nature of levee growth warrants burning thereof to facilitate inspection, the provisions of subparagraph b(1) of the regulations inconsistent therewith shall not apply. The manual may include the special instructions proposed in paragraph 6 of basic letter.

2. It is requested that the revised manual be submitted to this office for approval prior to issuance to the State agency.

BY ORDER OF THE CHIEF OF ENGINEERS:

F. J. Sullivan
Lt. Col. CE.
for H. C. GEE
Lt. Colonel, Corps of Engineers
Deputy Chief of Civil Works
for Flood Control

AIR MAIL

Subject: Operation and Maintenance
Manuals, Sacramento River
Flood Control Project
(Basic: 3 August 1949)

PSDGW 800.21 (Sacramento River
Calif) Sac Dist

(S-24, February 1950)

3rd Ind

South Pacific Division, Corps of Engineers, US Army, Oakland Army Base,
Oakland 14, California 23 November 1949

TO: Dist Engr, Sac Dist, Corps of Engrs, US Army, Sacramento, California


C. E. S.

Subject: Operation and Maintenance
Manuals, Sacramento River
Flood Control Project.
(Basic: 3 August 1949)

PSKGC 82163(Sac. R.F.C. Proj.) 4th Ind

Sacramento District, Corps of Engrs., U. S. Army, P. O. Box 1739,
Sacramento 8, California MAR 29 1950

To: The Division Engineer, South Pacific Division, Corps of Engrs.,
U. S. Army, Oakland 14, California

1. In compliance with suggestions contained in the preceding 2nd indorsement, the Operation and Maintenance Manual for the Sacramento River Flood Control Project has been revised to incorporate the changes recommended by this office in the basic letter dated 3 August 1949.

2. In accordance with paragraph 2 of referenced 2nd indorsement, the revised Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project is submitted herewith for approval.

1 Incl

1. Rev. Opern. & Maint.
Manual (in quad)

ENGINEER:

Chief Assistant

**Subject: Operation and Maintenance
Manuals, Sacramento River
Flood Control Project
(basic: 3 Aug. 1949)**

PSDGW 800.21(Sacramento
River, Calif)Sac Dist

5th Ind

South Pacific Division, Corps of Engineers, US Army, Oakland Army Base,
Oakland 14, California, 31 March 1950

To: Chief of Engineers, Department of the Army, Washington 25, D C

Approval recommended.

FOR THE DIVISION ENGINEER:

✓ 1 Incl
w/d - 1 cy

OWEN G. STANLEY
OWEN G. STANLEY
Chief, Engineering Division



ENCLWO

SUBJECT: Operation and Maintenance
Manuals, Sacramento River Flood Control
Project (Ltr Sac Dist to SFDiv 3 Aug 49)

6th Ind

Office of the Chief of Engineers, Washington 25, D. C., 27 June 1950

TO: The Division Engineer, South Pacific Division, Corps of Engineers,
OAKLAND, CALIFORNIA

1. The revised manual is approved, subject to the deletions indicated in red on pages 7, 8, 9 and 10 of the manual, the addition of the insertion indicated on page 10, and the following.

2. Certain statements in Section V appear to exceed the intended scope of a manual of this nature and of the instructions set forth in Orders and Regulations. It is requested that this Section be revised in the following particulars:

Page 12, paragraph 5-01, Mission, does not adequately describe the mission and should be deleted as it is unnecessary.

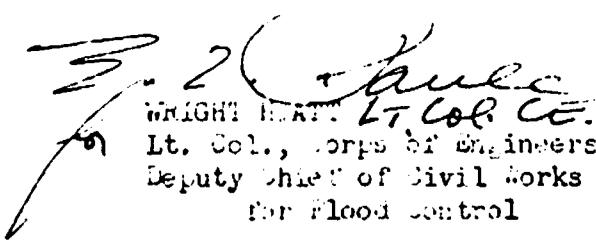
Page 13, paragraph 5-05. Delete "In the event local law enforcement agencies prove inadequate, local interests can request the aid of State forces, and if additional support becomes necessary, Federal troops can be requested as provided by law".

Page 13, delete entire paragraph 5-06, "Human element".

BY ORDER OF THE CHIEF OF ENGINEERS:

1 Incl

M & O Manual


WRIGHT HART, LT COL CE.
Lt. Col., Corps of Engineers
Deputy Chief of Civil Works
for Flood Control

Subject: Operation and Maintenance
Manuals, Sacramento River
Flood Control Project
(basic: 3 August 1949)

PSDGW 800.21(Sacramento River,
Calif)Sac Dist

7th Ind

South Pacific Division, Corps of Engineers, US Army, Oakland Army Base,
Oakland 14, California, 7 July 1950

To: Dist Engr, Sac Dist, Corps of Engineers, US Army, Sacramento, Calif

For compliance.

BY ORDER OF THE DIVISION ENGINEER:

H. D. G. Baxter

H. D. G. BAXTER

Acting Chief, Engineering Division

1 Incl - n/c

*new
part*

7/1/50

62-20(SAC.RIV. F.C.PROJ.)PSK 20