Volume 20

OPERATION AND MAINTENANCE MANUAL FOR

CHANNELS AND LEVEES OF THE MERCED COUNTY STREAM GROUP

See Revised Manual dated March 1984

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

SACRAMENTO, CALIFORNIA

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U.S. ARMY

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FOR
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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
June 1962

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OPERATION AND MAINTENANCE MANUAL
FOR
CHANNELS AND LEVEES OF THE
MERCED COUNTY STREAM GROUP

Section 1

INTRODUCTION

1-01. Authorization. The diversion channels of Black Rascal Creek to Bear Creek and Owens Creek to Mariposa Creek and channels as cleared by local interests were authorized as units of the plan of improvement for flood protection streams in the Merced County Stream Group in San Joaquin Valley, California, by Flood Control Act approved 22 December 1944. The authorization was based upon a report entitled "Merced County Streams, California" printed as House Document No. 473, Seventy-eighth Congress, Second Session.

1-02. Location. The diversion channel between Black Rascal Creek and Bear Creek lies about 4 miles east of the city of Merced in central California and is about 1.9 miles long. The diversion channel between Owens Creek and Mariposa Creek lies about 11 miles southeasterly of the City of Merced and is about 1.7 miles long. The extent of this portion of the project is shown on the locality map of EXHIBIT A-1 herewith. For more complete details see the "As Constructed" drawings of EXHIBIT B.

The streams comprising the Merced County Stream Group rise in the Sierra Nevada foothills of the Central Valley of California and flow in a general westerly direction to join the San Joaquin River west of the City of Merced. The streams form two general groups: Bear Creek with its tributaries, Black Rascal, Canal, Fahrens, and Burns Creeks; Mariposa Creek with its tributaries, Miles and Owens Creeks.

1-03. Description of Project Works.

a. The project covered by this manual and as constructed by the U. S. Corps of Engineers include the following:

(1) The Black Rascal Diversion Channel and levees along both banks for a length of about 10,000 feet.

(2) The Owens Creek Diversion Channel and levees along both banks for a length of about 8,780 feet.

(3) Gaging Stations.

b. Channel clearing work accomplished by local interests to increase channel capacities include the following:

(1) Enlargement of the channel of Miles Creek to provide a capacity of 1,000 cubic feet per second from section line common to sections 25 and 26, T.26S., R.15E. to El Nido Highway. 7S planada Merced

(2) Burns Creek: 2,000 cubic feet per second on Burns Creek from its confluence with Bear Creek upstream to the section line common to Sections 3 and 10, T. 7S, R. 15E. planada

(3) Bear Creek: 2,000 cubic feet per second from its confluence with Burns Creek upstream to the section line common to Sections 11 and 12, T. 7S, R. 15E: 7,000 cubic feet per second from head of Black Rascal Slough upstream to Black Rascal Diversion; 4,000 c.f.s. from Black Rascal Diversion to the confluence with Burns Creek. Merced Atwater Merced Planada

(4) Black Rascal Slough: Not less than 3,900 cubic feet per second and so that combined capacity of Black Rascal Slough and Bear Creek is not less than 7,000 cubic feet per second. Atwater

(5) Owens Creek; 400 cubic feet per second from Owens Creek Diversion to the bridge crossing at the section line common to Sections 29 and 30, T. 7S., R. 16E. planada

(6) Mariposa Creek: 1,000 cubic feet per second from Owens Creek Diversion upstream to the bridge located in S.W. 1/4 of Section 10, T. 8S., R. 16E; 1,250 cubic feet per second from El Nido Highway upstream to Owens Creek Diversion. planada

1-04. Protection Provided. The project work was designed to protect about 136,000 acres of land, the City of Merced and communities of Planada and Le Grand. During the irrigation season some channels are used for drainage and other channels for irrigation purposes. On the Owens Creek Diversion Channel the project design flow is 400 cubic feet per second from Owens Creek to Mariposa Creek. On the Black Rascal Creek Diversion Channel the project design flow is 3,000 cubic feet per second from Black Rascal Creek to Bear Creek. Channel capacities for Miles, Burns, Bear, Black Rascal, Owens and Mariposa Creeks are as listed in paragraph 1-03 of this manual. On the Owens Creek Diversion Channel the grade of the adopted flood plane varies in elevation from 240.5 feet on the upper end to elevation 234.0 feet at the lower end. On the Black Rascal Diversion Channel the grade of the adopted flood plane profile varies from

elevation 203.0 feet at the upper end to elevation 200.0 feet at the lower end. All elevations are referred to mean sea level datum. A freeboard of at least 3 feet above the project flood plane has been provided on levees constructed for this project.

1-05. Construction Data and Contractor. Construction contracts required by the U. S. Army Corps of Engineers to complete the project work as described under paragraph 1-03 of this manual was as follows:

a. Construction of the diversion channels, Black Rascal Creek to Bear Creek and Owens Creek to Mariposa Creek and Gaging Stations was accomplished under Contract No. DA-04-167-ENG-1376 by the Stockton Construction Company and completed on 13 April 1956.

1-06. Flood Flows. For purposes of this manual, the term "Flood" of "high water period" shall refer to flows when the water surface reaches or exceeds the following:

a. A reading of 14.0 on the gage located on the left bank of Bear Creek at the McKee Road.

b. A reading of 8.0 on the gage located on the left bank of the Black Rascal Creek Diversion channel at Yosemite Avenue.

c. A reading of 5.0 on the gage located on the right bank of Owens Creek Diversion Channel at Mission Avenue.

SECTION II

LOCAL COOPERATION REQUIREMENTS

2-01. Requirements of Local Cooperation. In House Document No. 473, 78th Congress, Second Session, the Chief of Engineers recommended construction of the Merced County Stream Group Project subject to the conditions that the State of California or other responsible local agencies give assurances satisfactory to the Secretary of War that they will (a) provide without cost to the United States all lands, easements and rights-of-way necessary for the construction; (b) bear the expense of all necessary highway and utility changes; (c) complete the enlargement of the channel of Miles Creek and restore the channel capacities of Black Rascal, Burns, Bear, Owens and Mariposa Creeks in accordance with the plan of the District Engineer; (d) hold and save the United States free from damages resulting from construction of the works; and (e) except for the reservoirs, dams, and appurtenant gages, maintain and operate the completed project works and existing channels in accordance with regulations prescribed by the Secretary of War.

Legislation authorizing participation by the State of California in the project was enacted under the California Statutes of 1955 ch.321, and is cited in Section 12650 of the State Water Code, which is quoted in part as follows:

> "The plan of improvement for flood protection on various streams in the Merced County Stream Group in the San Joaquin Valley is adopted and authorized substantially in accordance with recommendations of the Chief of Engineers in House Document Numbered 473, Seventy-eighth Congress, Second Session - - -"

2-02. Assurances Provided by Local Interests. The State of California by legislation enacted in 1955 has agreed to furnish the required cooperation. Section 12650 of the State Water Code states in part:

> "Notwithstanding any estimated cost to the State contained in this section, local cooperation which shall be furnished by the State in connection with the plan of improvement for flood protection on various streams in the Merced County Stream Group in the San Joaquin valley, adopted and authorized under this section shall include, without limitation as to the generality thereof:
>
> (a) Enlargement of the channel of Miles Creek to the extent indicated on Inclosure 3 of House Document Numbered 473, Seventy-eighth Congress, Second Session.

(b) Acquisition of lands, easements and rights-of-way necessary for construction of the following diversions to the capacities indicated:

(1) Owens Creek Diversion, 400 cubic feet per second.

(2) Black Rascal Diversion, 3,000 cubic feet per second.

(c) Providing the following capacities of the various creeks: . . . . . ." capacities ← TR 1-036

2-03. Transfer to the State Reclamation Board. Responsibility for operating and maintaining the completed works was officially transferred to the State Reclamation Board by letter dated 8 September 1956, as shown on the inclosed letter of transfer, EXHIBIT F.

SECTION III

MAINTENANCE AND OPERATION - GENERAL PROCEDURE

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

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

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

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

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

3-04. Definitions. As used hereinafter, the term "Superintendent" shall be defined to mean the person appointed by the local agency to be directly in charge of an organization which will be fully responsible for the continuous operation and inspection of the project works; the term "District Engineer" shall be defined to mean the District Engineer of the U. S. Army Engineer District, Sacramento Corps of Engineers, or his authorized representative. The term "right bank" or "left bank" shall be defined to mean the right or left bank or side, respectively, of a stream or channel when facing downstream.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(1) That all work shall be performed:

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

(b) To the satisfaction of the District Engineer

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

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

g. Inspection.

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

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

(2) For sake of uniformity, and to the extent practicable, the dates of inspection shall be as follows: 1 November, 1 May, and immediately following each flood flow in excess of a reading of 14.0 on the gage located on the left bank of Bear Creek at the McKee Road, 8.0 on the gage located on the left bank of the Black Rascal Diversion Channel at Yosemite Ave., or 5.0 on the gage located on the right bank of the Owens Creek Diversion Channel at Mission Ave. These gages are maintained by the U. S. Army Corps of Engineers.

(3) The check lists and instructions shown in EXHIBIT E, sheets 1 to 8, inclusive, are to be explicitly followed in each inspection to insure that no features of the protective system are overlooked. Check lists locally typed or printed in conformity with sheets 2, 4, and 6, shall have printed on the reverse side the applicable instructions shown on sheets 3, 5, and 8, EXHIBIT E. Carbon copy of the inspector's original field notes as recorded on the check list shall be transmitted to the District

Engineer immediately following each inspection, and one copy included as an inclosure to the semi-annual report as provided in paragraph 3-07(i)(1) of this manual.

h. Maintenance.

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

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

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

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

i. Reports.

(1) Semi-Annual Report. In accordance with the provisions of the Flood Control Regulations, paragraph 208.10(a)(6), the Superintendent

shall submit within a 10-day period following 1 December and 1 June of each year, a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works. This report will present a statement of:

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

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

(c) Prosecutions for encroachment or trespass.

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

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

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

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

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

3-08. Inspection Procedure. Since the enactment of State Legislation of Chapter 1528, Statutes of 1947, the Department of Water Resources, State of California, has made semi-annual inspections of all levees of authorized flood control projects in the Sacramento-San Joaquin drainage basin pursuant to the Federal Regulations of 16 August 1944 (Title 33), and reports its findings to the local agency, the State Reclamation Board, and the U. S. Army Engineer District, Sacramento Corps of Engineers. This activity, initiated pursuant to Section 208.10(a) of the Federal Regulations, has in effect provided for transfer from the local agencies to the State Department of Water Resources the obligation of compliance with Sections 8371, 8372, and 8373 of the Water Code of the State of California. These sections of the Code require the local responsible agencies to submit a report to the State Department of Water Resources on or before 1 June of each year on the condition of the levees within their jurisdiction. Supervisory powers and duties of the Department

are applicable to all works of the Sacramento River Flood Control Project maintained and operated by the local agencies without regard to status of completion, or expenditure of Federal funds on the construction of such works.

The following procedure is used in inspecting the levees of the responsible maintaining agency:

Personnel of the State Department of Water Resources make a detailed inspection in the spring and fall of each year and make a report on any required maintenance. The inspection objectives are to determine if the following items, which are a condensation of Federal Regulations, are being adhered to:

a. That all brush, trees and wild growth other than sod are removed from the levee crown and slopes.

b. That all weeds, grass and debris on the levee have been burned during the appropriate season, where not dangerous or impractical.

c. That all grass and weeds on the levee have been mowed where removal by burning is dangerous or impracticable. This applies only on peat levees or where burning would constitute a hazard to improvements.

d. That all burrowing animals have been exterminated.

e. That all caves, sloughs, burrows, holes, slips or other damaged portions of the levee have been repaired.

f. That all irrigation and drainage structures through the levee are in good working condition.

g. That no revetment work or riprap has been displaced, washed out or removed.

h. That the crown of the levee is well shaped and maintained and that unauthorized vehicular travel is restricted.

i. That stock grazing on the levee is restricted to conditions and seasons when the levee would not be seriously scarred or otherwise damaged thereby.

j. That encroachments are not being erected on the levee which would hinder travel by authorized patrol vehicles.

k. Prevent the erection of structures on, additions to, or alterations of, the levee unless authorized by permit from the State Reclamation Board.

Following this detailed inspection a joint field inspection is made with representatives of the responsible maintaining agency and the State Department of Water Resources to review and discuss the inspection report.

Upon completion of the fall inspection the State Department of Water Resources publishes an annual report entitled "Status of Project Levee Maintenance" which indicates the degree of proficiency attained by each obligated local agency in providing required maintenance.

SECTION IV

FEATURES OF THE PROJECT SUBJECT TO FLOOD CONTROL REGULATIONS

4-01. Project Works. Construction along the Black Rascal Creek Diversion Channel and the Owens Creek Diversion Channel, as covered by this manual, consist of enlargement of the locally constructed levees to project standards; channel improvement by enlargement of the channel to the extent necessary to lower the channel and to obtain borrow material for levee construction; a drop structure on the downstream end of the Black Rascal Creek Diversion Channel; stone protection at various locations; and irrigation and drainage structures. For further details see the drawings of EXHIBIT B. Channels cleared by local interests are as indicated in paragraph 1-03 of this manual.

4-02. Levees.

a. Description. For location and description of levees covered in this manual, see paragraph 1-02 and 1-03. Levees have been built to adopted grade and section by new construction with a waterside berm of 15 feet or better, waterside slope of 1 on 3 and landslide slope of 1 on 2. The levees of the Owens Creek Diversion Channel have a crown width of 12 feet and on the Black Rascal Creek Diversion Channel 20 feet. The patrol road surfacing consists of 4 inches of crushed mineral aggregate 10 feet in width for levee crowns of 12 feet and 12 feet in width for levee crowns 20 feet wide. Access ramps, turnouts and turnarounds are also surfaced. For more complete detail of items included in construction of the project levees, reference is made to the "As Constructed" drawings of EXHIBIT B. Regulations regarding inspection, maintenance and operation will be found in paragraph 4-02b, 4-02c and 4-02d of this manual.

b. Inspection.

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

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

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

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

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

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

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

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

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

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

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

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

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency. Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee . . ."

Note (a)

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

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

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

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

(b) Settlement of levee fill.

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

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

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

c. Maintenance.

(1) Repairs to Levee Embankment. Methods used for repair or reconstruction of the levee fill will depend on the extent of the damage section. If of small extent, the most suitable method will be to bring the levee back to line and grade by a fill made in 6-inch layers of earth free from brush, roots, sod or other unsuitable material. If of larger extent, the fill should be made in the same manner as the original construction, of selected material from borrow pits approved for the project placed in uniform layers of loose material and not more than 6 inches in depth and compacted in accordance with the specifications under which the work was completed or compacted according to approved construction practices. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the levees in time of flood.

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

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

(4) Burning. Along reaches of the levee where the practice of burning weeds, grasses and debris is conducted, extra precaution shall be taken to prevent fires from reaching asphaltic covered pipes and wooden structures. Prior to the time fires are started, all weeds, grasses and combustible materials shall be removed for a distance of at least 3 feet from pipes and structures that are susceptible to burning. Wet sacks or water sprays should be made available to workmen to prevent fires from reaching inflammable structures.

d. Operation.

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

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

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

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

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

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

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

(2) It shall be the duty of the local agency responsible for maintenance to keep in contact with the State Department of Water Resources Flood Operation Center during all periods of flood danger, and maintain a patrol of the project works in their area during periods of flood in excess of a reading of 14.0 on the gage located on the left bank of Bear Creek at the McKee Road, 8.0 on the gage located on the left bank of the Black Rascal Creek Diversion Channel at Yosemite Ave. and 5.0 on the gage located on the right bank of the Owens Creek Diversion Channel at Mission Ave. as referred to in paragraph 1-06 of this manual.

The Flood Operations Center is responsible for data collection and issuance of a joint forecast with the U. S. Weather Bureau and coordinates with the District Engineer, U. S. Army Engineer District Sacramento and other agencies to keep appraised of the current situation in accordance with terms of the Memorandum of Understanding dated 1 November 1956, between the Division Engineer, U. S. Army Engineer Division, South Pacific, and the Director, Department of Water Resources, State of California, for cooperative action during flood emergencies.

4-03. Channels and Floodways.

a. Description. The diversion channel between Owens and Mariposa Creeks was constructed to carry a flow of 400 cubic feet per second. The channel has a bottom width that varies from 16 feet at the upper end to 35 feet at the lower end with side slopes of 1 on 2 and berms of 15 feet for a length of about 8,780 feet.

On the diversion channel between Black Rascal Creek and Bear Creek the channel was excavated to carry 3,000 cubic feet per second. The bottom width is 60 feet with side slopes of 1 on 2 and berm widths of 15 feet or better for a length of about 9,900 feet. For further details, see the drawings of EXHIBIT B. Regulations regarding inspection, maintenance and operation of channels and floodways will be found in paragraphs 4-03b, 4-03c and 4-03d of this manual.

b. Inspection.

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

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

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

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

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

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

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

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

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

(2) The purpose of the flood-flow channels inspection is to insure that conditions which affect the channel capacity will remain the same, as far as possible, as those considered in the design assumptions and that no new conditions develop that may affect the stability of the project structures. At each inspection required by Paragraph 208.10(g)(1) of the Flood Control Regulations, particular attention will, therefore, be given the following:

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

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

(c) Rubbish and industrial waste disposal.

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

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

(f) Condition of project structure.

1. Channel walls;

a. Deviation from alignment and grade.

b. Development of cracks and spalls.

c. Mechanical injuries.

2. Fencing:

a. Injuries to posts, fencing or barbed wire.

b. Damage to galvanizing.

3. Earth fills:

a. Settlement.

b. Erosion of both slopes.

c. Excessive seepage or saturation area back of fills.

4. Right-of-Way:

a. Presence of dumped refuse.

b. Encroachment or trespass.

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

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

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

c. Maintenance.

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

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

(3) Dumped rock or other suitable types of protection should be placed at locations found by experience to be critical trouble points, with a view to

stabilizing the channel alignment and preserving the general uniformity of the bank lines.

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

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

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

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

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

d. Operation.

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

"(g) Channels and floodways (2) Operation. Both banks of the channel shall be patrolled during periods of high water . . . Appropriate measures shall be taken to prevent the formation of jams . . . of debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high

water period. As soon as practicable thereafter all snags and other debris shall be removed and all damage to . . . walls, drainage outlets or other flood control structures repaired."

4-04. Drainage and Irrigation Structures.

a. Description. Drainage and irrigation structures which extend through the levees are listed as follows:

Levee Mile	Size of Pipe	Other Description	Feet Below Crown
Unit No. 1 - Black Rascal Creek Diversion Channel - Right Bank			
0.00	6' x 6' Concr.	Inverted siphon under channel	----
1.32	36" CMP	Riser unit L-S	10.0
Unit No. 2 - Black Rascal Creek Diversion Channel - Left Bank			
0.00	10" Steel	Riser unit L-S	5.0
0.29	24" CMP	Flap gate W-S	8.0
0.73	24" CMP	Flap gate W-S	8.0
0.91	2 - 60" CMP	Flap gate W-S	10.0
1.32	24" CMP	Flap gate W-S	10.0
1.64	24" CMP	Flap gate W-S	8.0
Unit No. 1 - Owens Creek Diversion Channel - Right Bank			
0.18	24" CMP	Flap gate W-S	6.0
0.40	24" CMP	Flap gate W-S	10.0
0.59	24" CMP	Flap gate W-S	10.0
0.80	24" CMP	Flap gate W-S	10.0
0.04	24" CMP	Flap gate W-S	5.0
1.17	24" CMP	Flap gate W-S	6.0
1.29	24" CMP	Flap gate W-S	4.0
Unit No. 2 - Owens Creek Diversion Channel - Left Bank			
0.10	24" CMP	Flap gate W-S	5.0
0.17	24" CMP	Flap gate W-S	6.0
0.31	24" CMP	Flap gate W-S	6.0
0.45	24" CMP	Flap gate W-S	5.0
0.58	24" CMP	Flap gate W-S	6.0
0.82	24" CMP	Flap gate W-S	6.0
1.02	24" CMP	Flap gate W-S	8.0
1.10	24" CMP	Flap gate W-S	10.0
1.24	24" CMP	Flap gate W-S	10.0

Note on abbreviations:

CMP = Corrugated Metal Pipe
W-S = Waterside
L-S = Landside

b. Inspection.

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

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

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

(ii) Inlet and outlet channels are open;

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

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

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

(2) After each inspection required immediately prior to the beginning of the flood season; immediately following each major high water period and at such other times as may be necessary to insure the best possible care of the levee, the following items, if applicable, shall be particularly noted:

(a) Debris or other obstructions to flow.

(b) Condition of pipes and gates.

(c) Damage or settlement of pipe.

(d) Condition of concrete-cracks, spall, 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. For this purpose it is recommended that the repair be made by thoroughly cleaning the surface by sandblasting and building up the concrete to its original section with pneumatically-placed Portland cement mortar. All evidences of settlement, uplift, or failure of concrete structures should be referred to the State Engineer for analysis and recommendation of remedial measures.

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

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

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

d. Operation.

(1) Pertinent Regulations of the Code of Federal Regulations. Flood Control Regulations, paragraph

208.10(d)(2) are quoted in part as follows:

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

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

4-05. Miscellaneous Facilities.

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

(1) Bridges. The following bridges across the diversion channels within the project:

(a) On the Owens Creek Diversion Channel there are the Mission Ave., Santa Fe Railroad and Planada Road bridge crossings.

(b) On the Black Rascal Creek Diversion Channel there are the Yosemite and Olive Avenue bridge crossings.

(2) Utility Relocations. Because of the nature of the construction of utilities by local interests, records of utility relocations are not available.

(3) Hydrologic Facilities. The following continuous water stage recorders and staff gages are located within the project and are to be maintained by the U. S. Corps of Engineers.

(a) A gage on the left bank of Bear Creek at the McKee Road.

(b) A gage on the left bank of the Black Rascal Creek Diversion Channel at Yosemite Ave.

(c) A gage on the right bank of the Owens Creek Diversion Channel at Mission Ave.

(4) Siphons and Drop Structure.

(a) Siphon across Owens Creek Diversion Channel at confluence with Mariposa Creek.

(b) On Owens Creek Diversion Channel a siphon crosses under the Santa Fe Ave.

(c) A concrete drop structure at confluence of Black Rascal Creek Diversion Channel with Bear Creek.

b. Inspection and Maintenance.

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

"(h) Miscellaneous Facilities. (1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be replaced without delay. ."

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

(3) The interest of the Corps of Engineers and the responsibility of the local interests in the existing highway and railroad bridges is confined to their effect on the safety and functioning of the flood control channel, but any conditions noted in the inspections that may

affect them in any way should as a matter of courtesy, be brought to the attention of the agencies maintaining and operating them. If the inspection of any miscellaneous structure, either existent or constructed in the future under permit, discloses any condition that indicates the probability of failure during periods of high water, the Superintendent shall address a letter to the owner of the structure, quoting this manual as authority and inviting attention to the conditions observed and requesting that immediate steps be taken to correct them. A copy of such letter shall be forwarded to the District Engineer for his information. A report on the action taken by the owner shall be submitted to the District Engineer to accompany the next semi-annual report. A suggested report is included as EXHIBIT D of this manual.

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

c. Operation

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

"(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. These 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 V

SUGGESTED METHODS OF COMBATING FLOOD CONDITIONS

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

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

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

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

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

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

b. Condition of new levees and recent repairs.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

a. Drainage of Slopes. This work can be done economically while awaiting developments and will serve to make the levees more efficient. Crews should be organized to cut seep drains at all places on the levee and berm when seepage appears. The drains should be V-shaped, no deeper than necessary, and never more than 6" deep. Care

must be taken not to cut the sod unnecessarily. In all instances, drains should be cut straight down the levee slope or nearly so. Near the toe of the slope the small drains should be Y'd together and led into larger drains, which, in general, should lead straight across the landside berm into the landside pits or nearest natural or artificial drain.

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

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

d. Scours. A careful observation should be made of the riverside of the levee at all localities where a current of more than two feet per second is observed, or where the profiles show a high water slope of two feet per mile or greater. Trouble may be looked for at the ends of old levee dikes, road-crossing ramps, old traverses, and places where pipes, sewers and other structures penetrate the levee. If any sign of scour is observed in the pits or at the ends of the dikes, soundings should be taken to observe the amount and progress of the scour. The approved method of construction to check scour in the pits, on the slopes, or at the ends of dikes will be to construct deflection dikes using brush, treetops, or lumber, driving stakes and wiring together, and filling in between with brush and filled sacks or stone.

e. Caving Bank Protection. As protection against active caving of riverbanks, rock-filled cribs are very effective if properly 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 spaced about 3 feet center-to-center. On top of the cover, perpendicular to the direction of the cover boards, are three pairs of top boards, one over each of the side walls and one over the central division wall. All intersections are nailed with one 20d nail. The compartments are filled with rock before covering. Each wall intersection of the fabricated cribs is securely fastened by a loop of No. 9 wire. See EXHIBIT C, plate 4.

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

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

b. Lumber and Sack Topping. This is the most commonly used method of raising low reaches in emergencies. In putting on this topping, as well as other topping, a careful line of levels should be run and grade stakes set in advance. 2" x 4" x 6' stakes should then be driven on the riverside of the crown six feet apart, and 1" x 12" boards nailed to the landside of the stakes. This wall, backed with a single tier of sacks, will hold out at least one foot of water. If a second foot is necessary, the layers of sacks will have to be increased in number and reinforced. The stakes should be driven three feet in the ground, and should project out three feet, thus providing, in extreme cases, a three-foot topping if properly braced behind with sacks and earth. In some instances, it may be practicable to back up the planking with tamped earth obtained in the vicinity in lieu of the sacks shown in the drawing, EXHIBIT C, plate 5.

5-10. Transportation. 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 radio communication should be provided along dangerous stretches of the levee when travel or other satisfactory means of communication cannot be maintained.

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

EXHIBIT A

FEDERAL FLOOD CONTROL REGULATIONS

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS

MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(ii) Inlet and outlet channels are open;

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

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

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

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

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

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

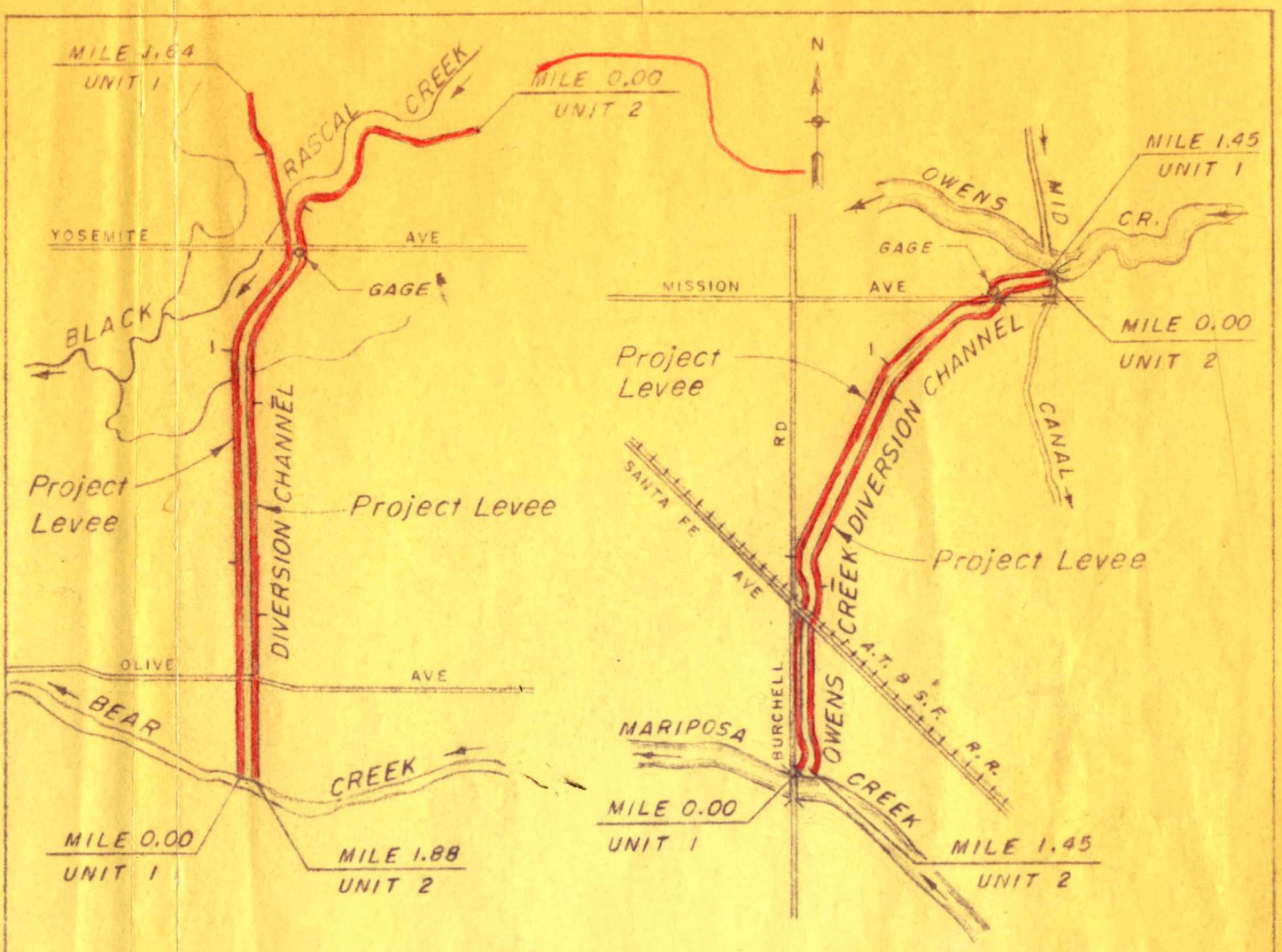
(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the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

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

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

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

EXHIBIT "A" Sheet 2 of 2



LEGEND

---Extent of Levees

SCALE IN MILES

0 ½ 1 MILE

LOCATION MAP

MERCED COUNTY STREAM GROUP,
CALIFORNIA
FLOOD CONTROL PROJECT
CHANNELS AND LEVEES

EXHIBIT A-1

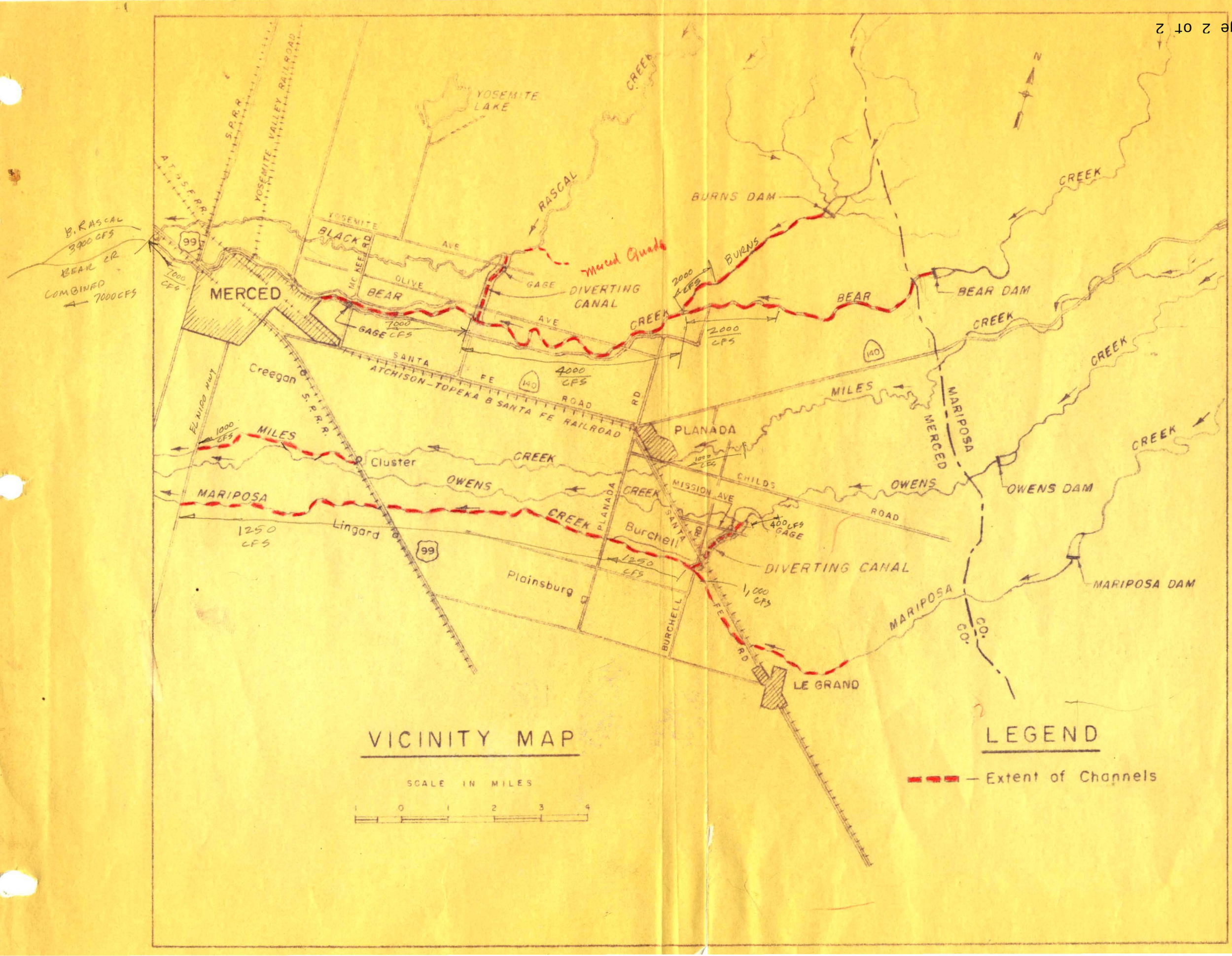

VICINITY MAP
SCALE IN MILES
1 0 1 2 3 4
LEGEND
— Extent of Channels
B. RASCAL 3900 CFS
BEAR CR
COMBINED 7000 CFS
7000 CFS
MERCED
99
A.T.&S.F.R.R.
S.P.R.R.
YOSEMITE VALLEY RAILROAD
YOSEMITE LAKE
RASCAL CREEK
BLACK RD
YOSEMITE AVE
MC KEE RD
OLIVE AVE
BEAR CREEK
GAGE
DIVERTING CANAL
Merced Quads
BURNS DAM
BURNS CREEK
2000 CFS
BEAR DAM
BEAR CREEK
7000 CFS
GAGE
SANTA FE ROAD
ATCHISON-TOPEKA & SANTA FE RAILROAD
4000 CFS
140
Creegan
EL NIDO HWY
S.P.R.R.
1000 CFS
MILES CREEK
Cluster
OWENS CREEK
MARIPOSA CREEK
1250 CFS
Lingard
Plainsburg
PLANADA
Burchell
BURCHELL RD
MISSION AVE
CHILDS ROAD
400 CFS GAGE
DIVERTING CANAL
1,000 CFS
LE GRAND
MARIPOSA CO.
MERCED CO.
OWENS DAM
MARIPOSA DAM
N

EXHIBIT B

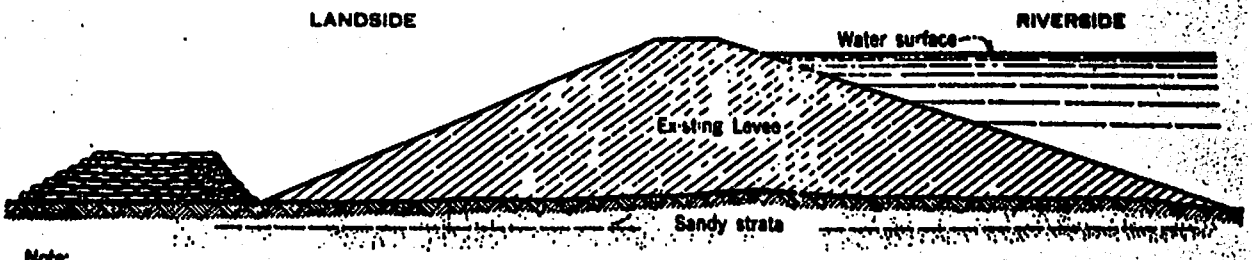
"AS CONSTRUCTED"
DRAWINGS
(See separate folder for the following drawings)

FILE NO.	
ME-6-3-7	Diversion Channel, Owens Creek to Mariposa Creek, in 4 sheets.
ME-8-3-9	Diversion Channel, Black Rascal Creek to Bear Creek, in 5 sheets.
ME-25-22	Stream Gaging Stations, in 2 sheets.

EXHIBIT B
Unattached

EXHIBIT C

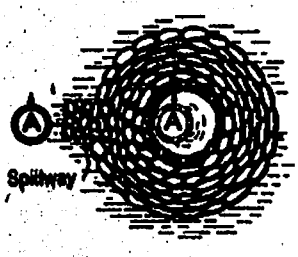
PLATES OF SUGGESTED FLOOD FIGHTING METHODS

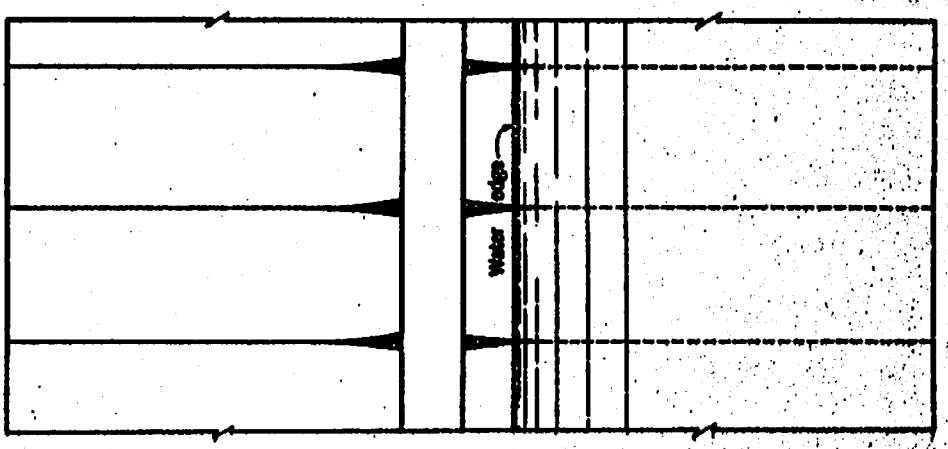


Note:
Bottom width to be no ess than 1½ times height.
Be sure to clear sand discharge.
Tie into levee if boil is near toe.

ELEVATION

SECTION A-A





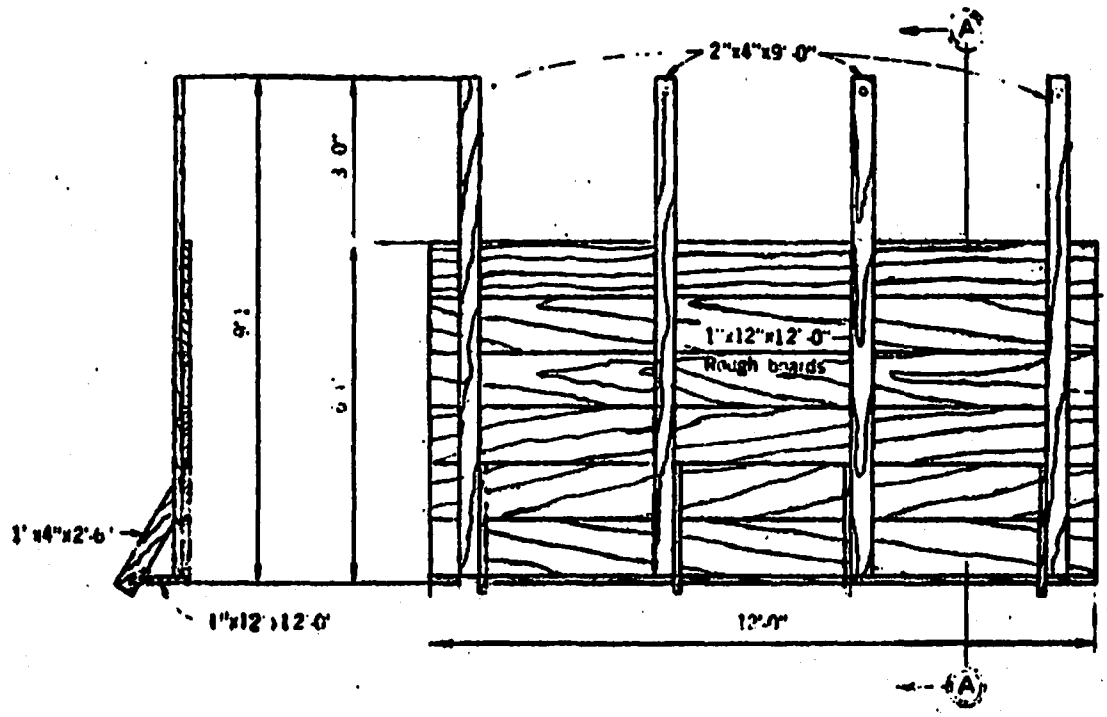
PLAN

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

MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

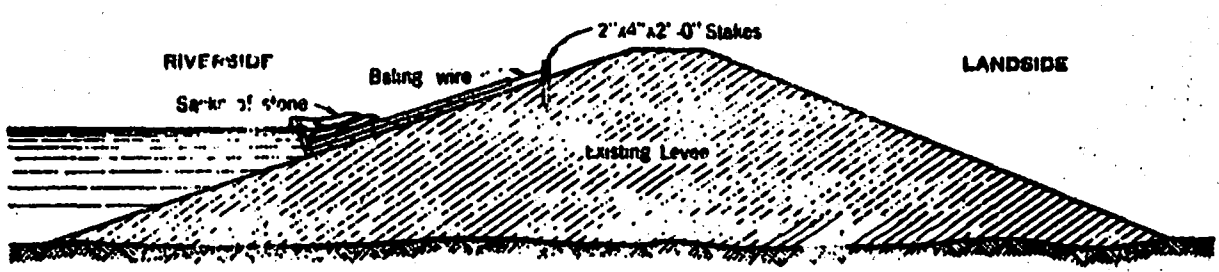
CONTROL OF SAND BOILS

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



SECTION A-A

PLAN



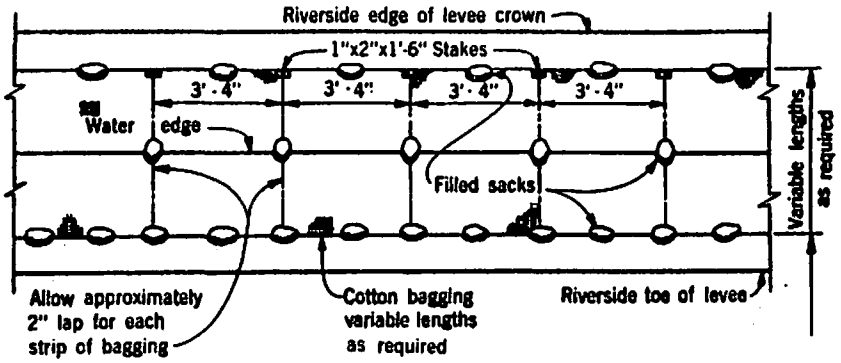
SECTION

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

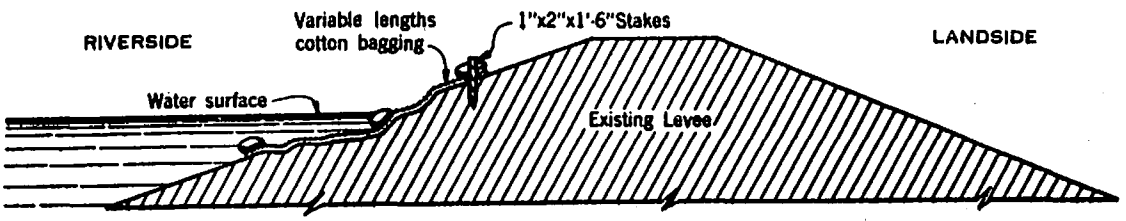
MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

MOVABLE WAVE WASH PROTECTION

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



PLAN



SECTION

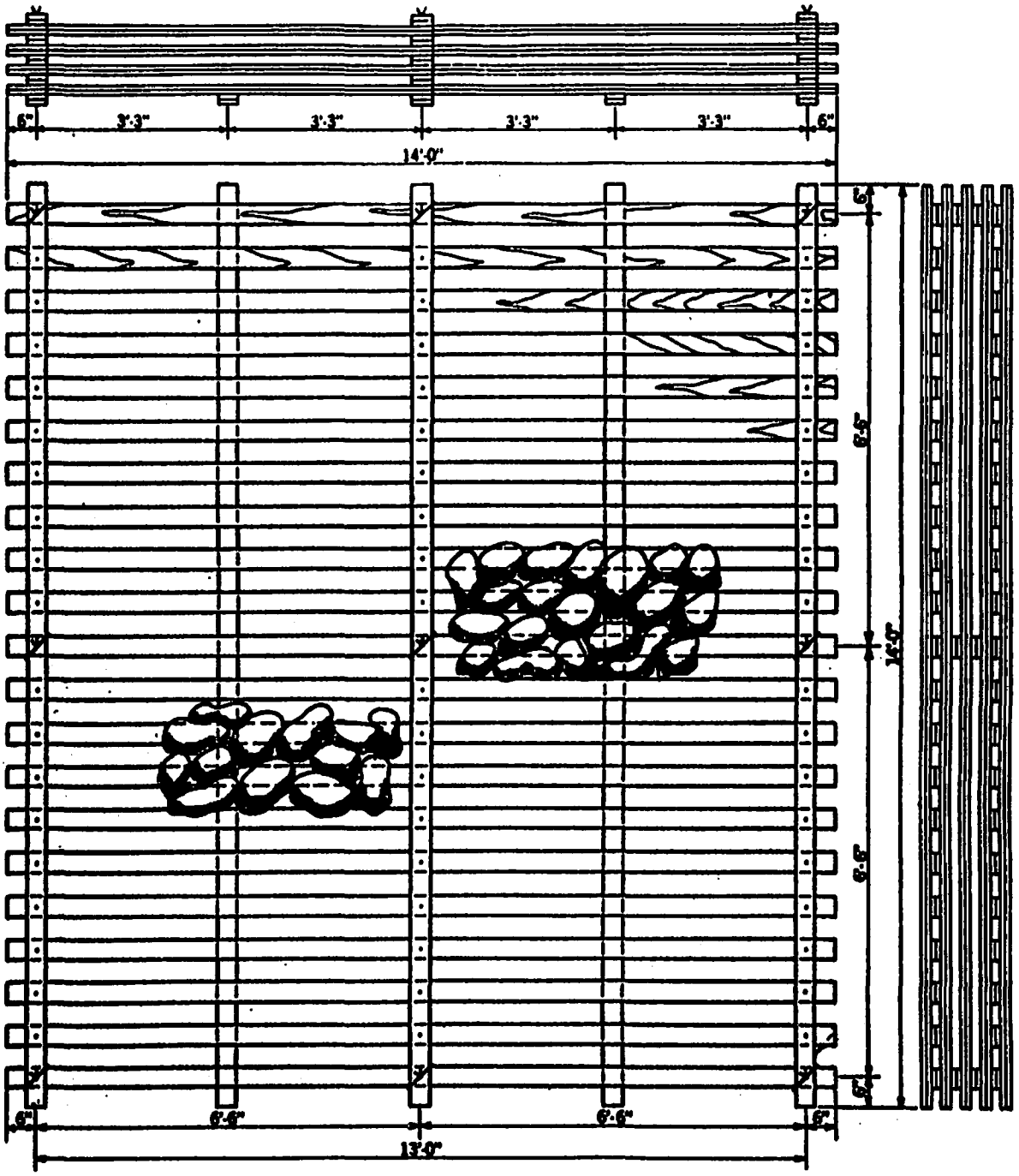
Note:
Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water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

MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

WAVE WASH PROTECTION

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



Note:

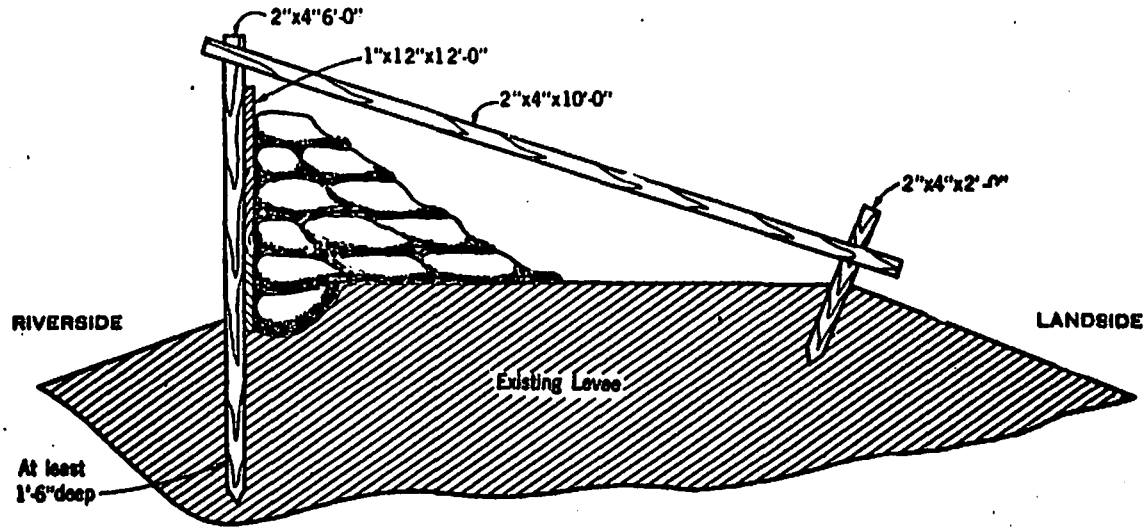
Cribs constructed of double thickness of 1"x4"x14'-0" lumber. Nail all intersections with 1-20d nail. Each intersection of walls securely fastened by a loop of No. 9 wire, tightly twisted.

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

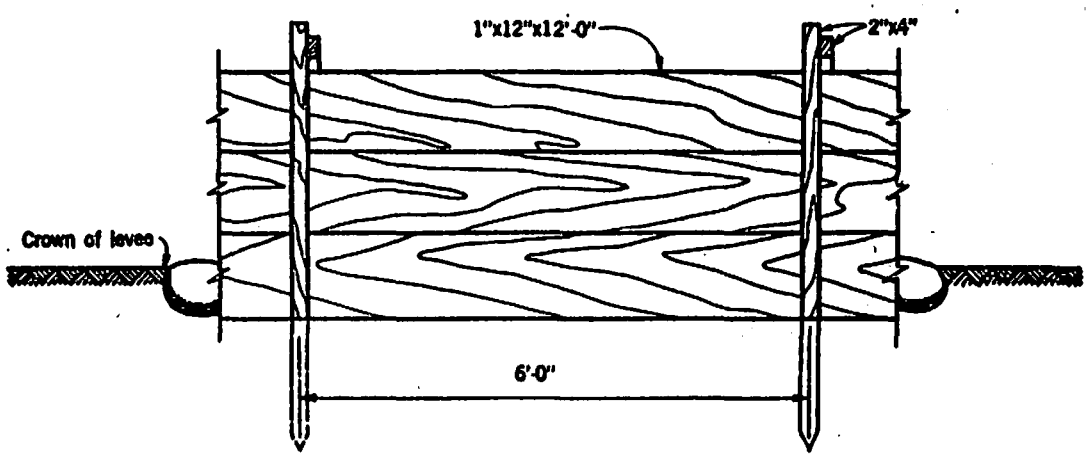
MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

CAVING BANK PROTECTION

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



SECTION



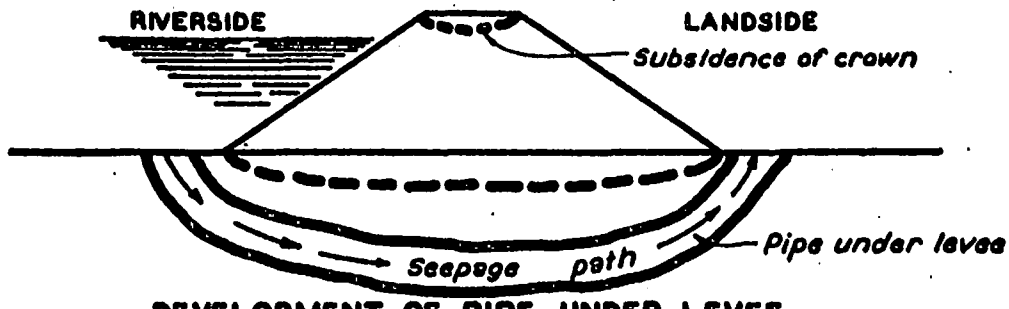
FRONT ELEVATION

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

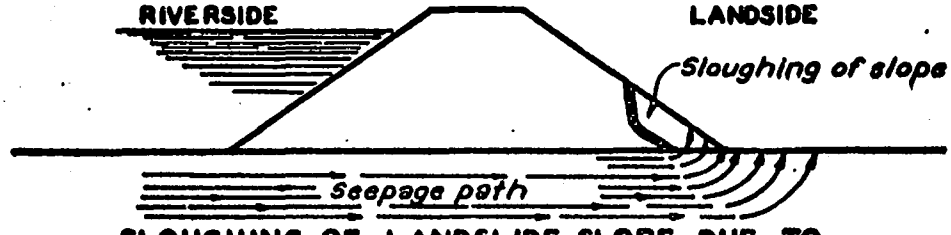
MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

LUMBER AND SACK TOPPING

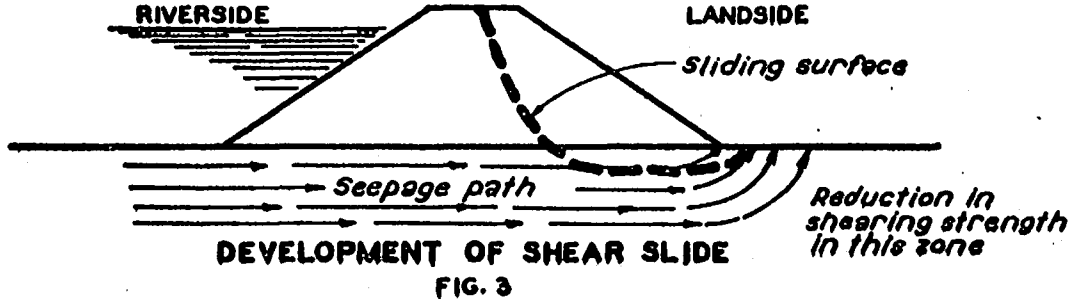
U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.
MAY, 1946



DEVELOPMENT OF PIPE UNDER LEVEE
FIG. 1



SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE
FIG. 2

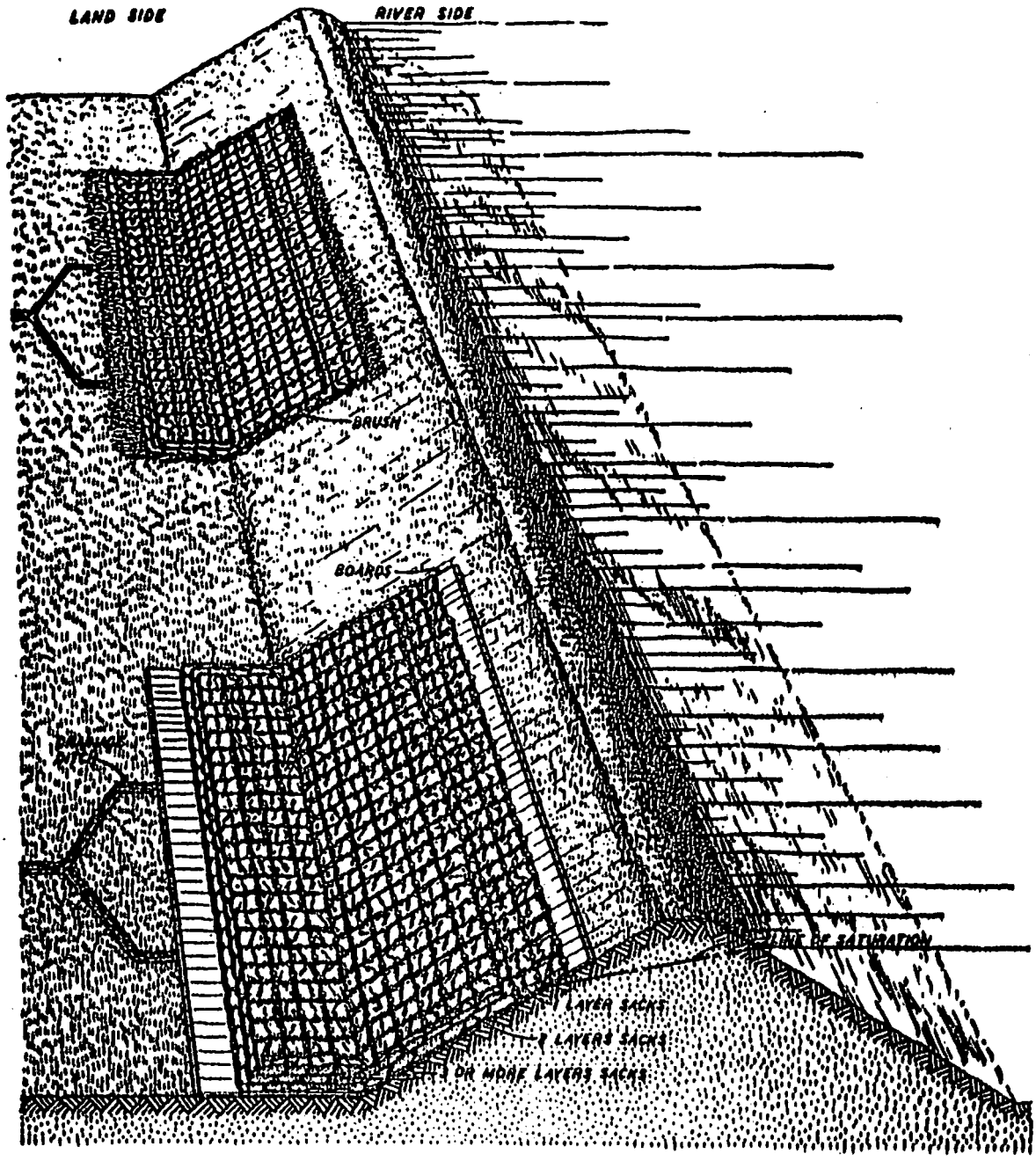


DEVELOPMENT OF SHEAR SLIDE
FIG. 3

MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

EFFECTS OF SAND BOILS ON LEVEE

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

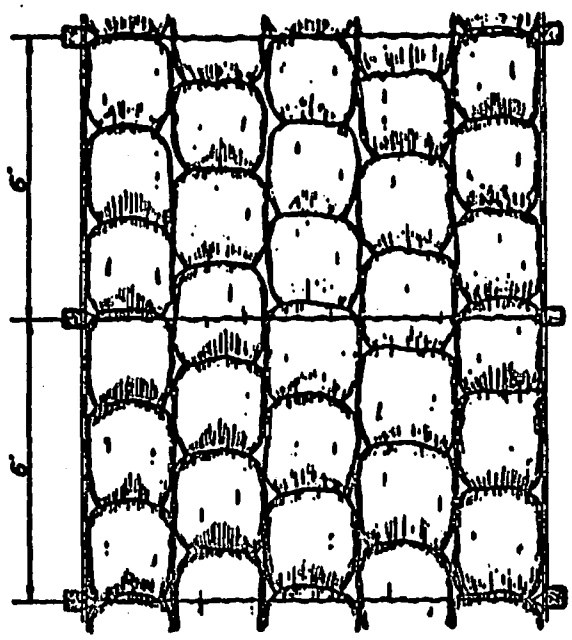


MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

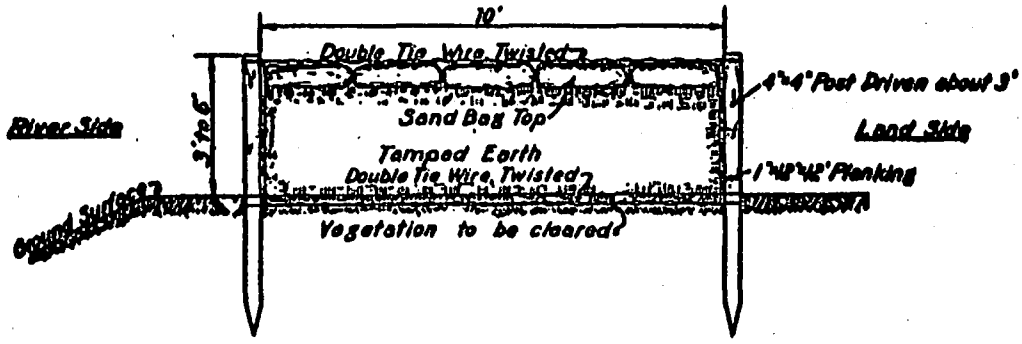
BRUSHING AND SACKING THE LANDSIDE SLOPE

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

EXHIBIT O PLATE 7



PLAN



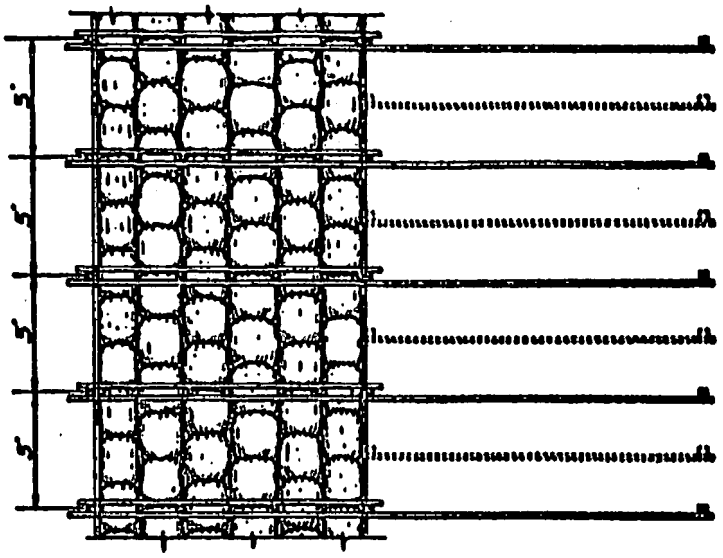
END ELEVATION

MATERIAL REQUIRED FOR 100 LINEAR FEET OF LEVEE		
4 FT HIGH	5 FT HIGH	6 FT HIGH
34 pieces 4"x4"x7' (sharpened) } 1122 board feet 67 pieces 1"x12"x12' 25 lbs. wire #12 gage 13 lbs. 10d nails 600 sand bags 148 cu. yds. earth	34 pieces 4"x4"x8' (sharpened) } 1371 board feet 84 pieces 1"x12"x12' 25 lbs. wire #12 gage 15 lbs. 10d nails 600 sand bags 185 cu. yds. earth	34 pieces 4"x4"x9' (sharpened) } 1605 board feet 100 pieces 1"x12"x12' 25 lbs. wire #12 gage 17 lbs. 10d nails 600 sand bags 222 cu. yds. earth

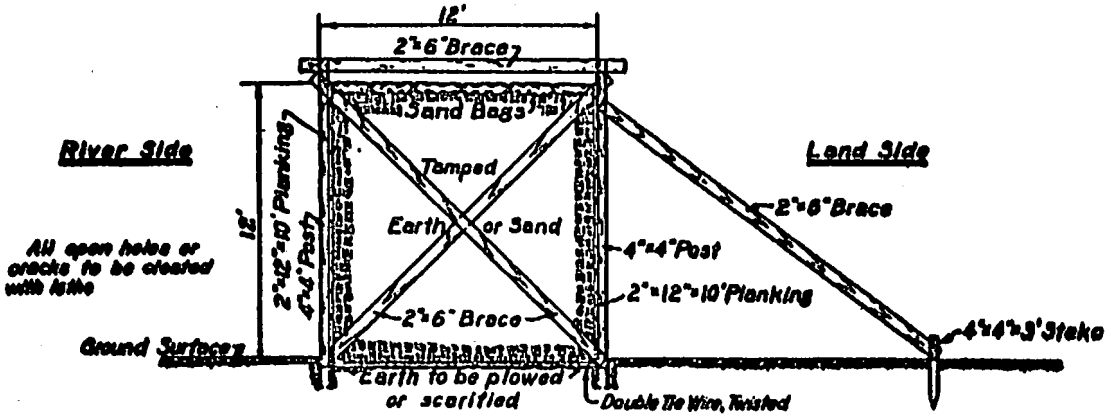
MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

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"x4"x14' 240 Planks 2"x12"x10' 20 Braces 2"x6"x14' 60 Braces 2"x6"x10' *20 Stakes 4"x4"x3' 5 bundles lathe	700	120 lbs.-20d 4 lbs.-3d fine WIRE 20 lbs.-12 gage	534 cu. yds.
Total Lumber 6987 board feet.			

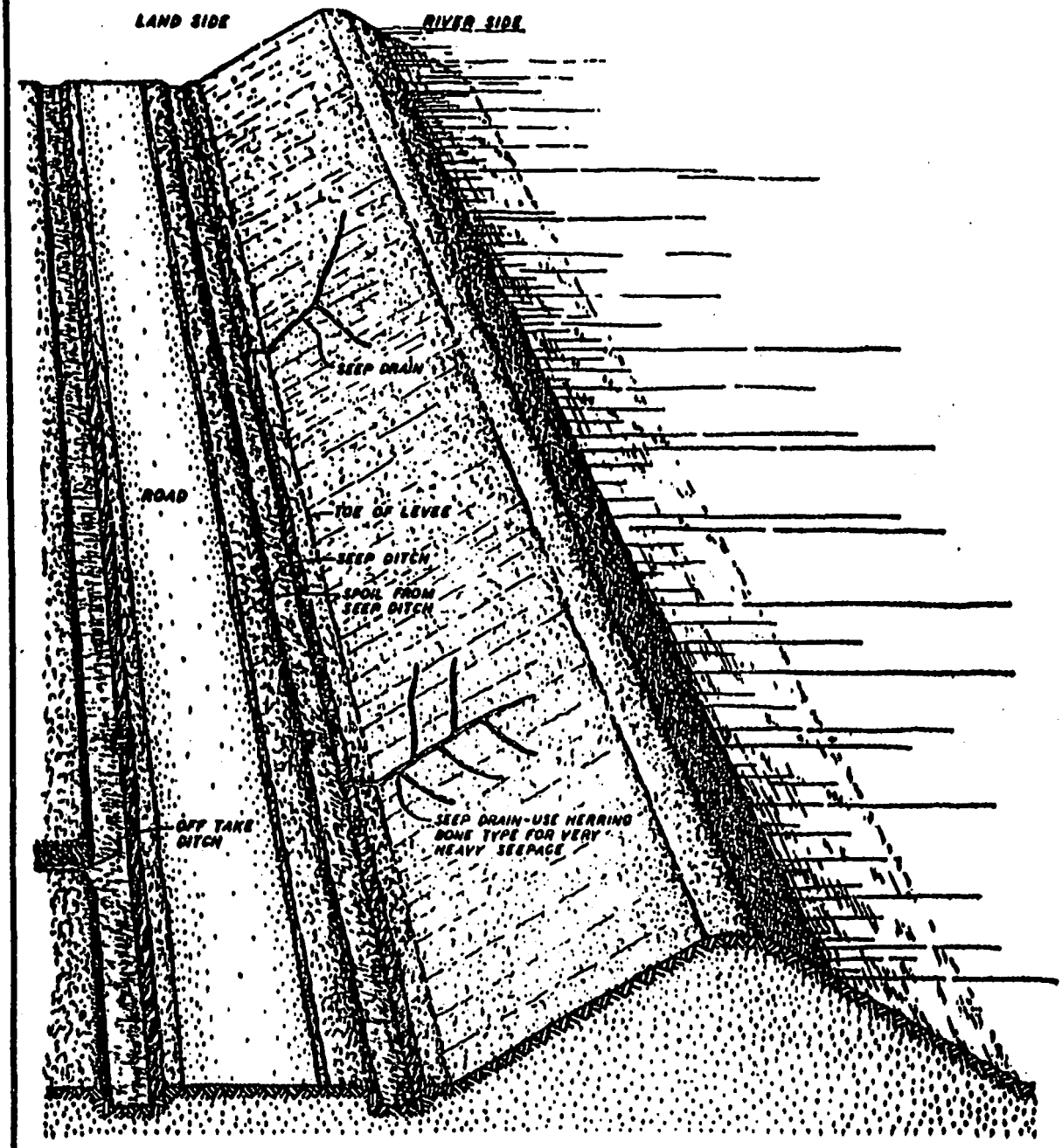
ADDITIONAL MATERIAL FOR BRACING BACK SIDE IN BETWEEN BENTS			
LUMBER	SAND BAGS	NAILS	EARTH or SAND
20 Posts 4"x4"x14' 20 Braces 2"x6"x10' *20 Stakes 4"x4"x3'		6 lbs.-20d	
Total Lumber 613 board feet.			

* Sharpened

MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

MUD BOX BULKHEAD LEVEE CONSTRUCTION DETAILS

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



MERCED COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

METHOD OF DRAINING LEVEE SLOPE

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

EXHIBIT G PLATE 10

EXHIBIT D

SUGGESTED SEMI-ANNUAL REPORT FORM

TO: The District Engineer (1 May 19___)
U. S. Army Engineer District, Sacramento (1 Nov 19___)
Corps of Engineers
Federal and Courts Building
650 Capitol Avenue
Sacramento 14, California

Dear Sir:

The semi-annual report for the period (1 May 19___ to 31 October 19___) (1 November 19___ to 30 April 19___) Merced County Stream Group Project Levee and Channel Improvements, Merced County, is as follows:

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

(Superintendent's summary of conditions)

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

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

b. During this report period, major high water periods (water surface in Bear Creek reached or exceeded the gage readings of 14.0; Black Rascal Creek Diversion Channel at Yosemite Ave. 8.0; Owens Creek Diversion Channel at Mission Ave. 5.0) occurred on the following dates:

Dates	Maximum Elevation
_____	_____
_____	_____
_____	_____

EXHIBIT D
Sheet 1 of 2

Comments on the behavior of the protective works during such high water periods are as follows:
(Superintendent's log of flood observations)

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

(See Maintenance Manual for Merced County Stream Group)

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

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

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

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

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

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

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

Respectfully submitted,

_____
Superintendent of Works

EXHIBIT D
Sheet 2 of 2

EXHIBIT E

SUGGESTED CHECK LISTS OF LEVEES, CHANNELS AND STRUCTURES

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

CHECK LIST NO. 2

MERCED COUNTY STREAM GROUP

LEVEES AND CHANNEL IMPROVEMENT

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendent _____

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

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

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

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

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

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

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

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

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

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

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

CHECK LIST NO. 3

MERCED COUNTY STREAM GROUP

LEVEES AND CHANNEL IMPROVEMENT

Inspector's Report Sheet No. ___ Inspector _____

Date _____ Superintendent _____

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

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

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

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

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

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

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

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

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

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

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

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

SUGGESTED CHECK LIST NO. 4

DRAINAGE AND IRRIGATION STRUCTURES

MERCED COUNTY STREAM GROUP

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendant _____

(a) Location by levee mileage	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of right-of-way adjacent to structure	(g) Repair Measures taken since last inspection	(h) Comments
0.00	Rt.	Unit No. 1 - Black Rascal Diversion Channel					
1.32	Rt.						
		Unit No. 2 - Black Rascal Diversion Channel					
0.00	Lt.						
0.29	"						
0.73	"						
0.91	"						
1.32	"						
1.64	"						

SUGGESTED CHECK LIST NO. 4

DRAINAGE AND IRRIGATION STRUCTURES

MERCED COUNTY STREAM GROUP

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendent _____

(a) Location by levee mileage	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of-way adjacent to structure	(g) Repair measures taken since last inspection	(h) Comments
		Unit No. 1 - Owens Creek Diversion Channel					
0.18	Rt.						
0.40	Rt.						
0.59	Rt.						
0.80	Rt.						
1.04	Rt.						
1.17	Rt.						
1.29	Rt.						
		Unit No. 2 - Owens Creek Diversion Channel					
0.10	Lt.						
0.17	Lt.						
0.31	Lt.						
0.45	Lt.						
0.58	Lt.						
0.82	Lt.						
1.02	Lt.						
1.10	Lt.						
1.24	Lt.						

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

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

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

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

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

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

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

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

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

EXHIBIT F

LETTER OF TRANSFER TO
THE STATE RECLAMATION BOARD

Red. !
Good Service!
JM

CO
open

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN, Governor

THE RECLAMATION BOARD
1416 - 9TH STREET ● SACRAMENTO 95814

...LEY W. KRONICK, *President*
J. J. MADIGAN, *Vice President*
WALLACE McCORMACK, *Secretary*
GEORGE W. NICKEL, JR.
HAROLD J. O'BANION
MAX S. VANN, SR.
DONALD L. WEILER
COL. A. E. McCOLLAM, *General Manager*

FEB 5 1965

Refer to: 7001.40.001
4130.40.001

District Engineer
Corps of Engineers
U. S. Army
650 Capitol Mall
Sacramento, California - 95808

Dear Sir:

Reference is made to your letter of 8 September 1956, concerning transfer to the State of California of channel and levee construction on the Merced County Stream Group, in accordance with Specification No. 1930.

The Reclamation Board, at its meeting of February 5, 1965, formally accepted the above referred to work for operation and maintenance.

Sincerely yours,

A. E. McCollam

A. E. McCOLLAM
General Manager

JHMacC:gg

C
O
P
Y

C
O
P
Y

8 September 1956

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

acceptance letter dtd 5 Feb 1965

Gentlemen:

Reference is made to District Engineer's letter dated 25 November 1955 suggesting a joint inspection of the Merced County Stream Diversion Channels, for the purpose of transferring them to the jurisdiction of the State of California for operation and maintenance. Reference is also made to the joint inspections of these diversion works on 29 November 1955 and 12 April 1956. The location and description of work of these units are described as follows:

Unit No.	Location and Description of Work
1	Diversion Channel, approximately 9,918 feet in length from Black Rascal Creek to Bear Creek, Sta. 28 + 18 to 71 + 00, Drawing No. ME-8-3-9.
2	Diversion Ditch, approximately 1,850 feet in length with its head at Sta 16 + 45 and connecting with Black Rascal Creek Diversion Channel at Sta. 1 + 40, Drawing No. ME-8-3-9.

Unit No.	Location and Description of Work
3	Levee along the left bank of Black Rascal Creek Diversion Channel, approximately 10,070 feet in length from Sta. - 31 + 40 to 69 + 30, Drawing No. ME-8-3-9.
44	Levee along the right bank of Black Rascal Creek Diversion Channel, approximately 7,030 feet in length, from Sta. - 1 + 00 to 69 + 30, Drawing No. ME-8-3-9.
5	Levee along the left bank of Owens Creek Diversion Channel, approximately 6,780 feet in length, from Sta. 20 + 00 to 87 + 80, Drawing No. ME-6-3-7.
6	Diversion Channel, approximately 8,780 feet in length, from Owens Creek to Mariposa Creek, Sta. 0 + 00 to 87 + 80, Drawing No. ME-6-3-7.
7	Levee along the right bank of Owens Creek Diversion Channel, approximately 8,750 feet in length, from Sta. 0 + 00 to 87 + 50, Drawing No. ME-6-3-7.

The work referred to above was completed on 13 April 1956, in accordance with Specification No. 1930, under Contract No. DA-04-167-eng-1376 and Drawing No. ME-8-3-9, ME-6-3-7 and ME-13-61, and meets with the requirements of the Flood Control Project for the improvement of the Merced County Stream Group which is covered in House Document No. 473, 78th Congress, 2nd Session, approved by the Flood Control Act of 22 December 1944. Therefore, said units of work, Nos. 1 to 7 inclusive, are hereby transferred to the State of California for operation and maintenance.

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

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

Sincerely yours,

LEON J. HAMERLY
Lt. Col., CE
Acting District Engineer

1 Incl
1 F.C. Reg.

EXHIBIT G

SAMPLE PERMIT
FOR
USE OF RIGHT-OF-ENTRY

EXHIBIT
PERMIT

_____
(Name of Levee Commission or City)

_____
(Location)

Permission is hereby granted to:

_____ _____
(Name of Firm or individual) (Address

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

_____

_____

_____

_____

Provided That:

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

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

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

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

The construction, installation and maintenance of the structure or major construction, the cost of inspection thereof by the grantor and/or the United States shall be paid by the applicant.

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

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

_____

_____

_____

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

Signature (Grantor) (Title) (Date)

Terms of this permit are hereby accepted

Approved:

(Signature (Grantee) (Date)

(Date)

District Engineer

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

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

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

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

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

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

20

US Army Corps
of Engineers
Sacramento District

MERCED COUNTY, CALIFORNIA

OPERATION AND MAINTENANCE MANUAL

CHANNELS AND LEVEES OF THE MERCED COUNTY STREAM GROUP

Source: Merced Co. Streams, DM No 11. pgs 79 & 83 (dtd Sept '83)

Channel improvements on Bear Creek extend upstream from Eastside Bypass to Black Rascal (Fahrens Cr). Channel upstream to Black Rascal Div to carry 7000 cfs in accordance with existing project (see below).

29. Local Interest Work. - In accordance with the requirements of local cooperation for the existing Merced County Streams Group Project, the State of California is required to provide and maintain various stream capacities, including a capacity of 7,000 cfs in Bear Creek between Black Rascal Creek and Black Rascal Creek diversion. Our investigations indicate that some work may be required on Bear Creek upstream of Black Rascal Creek to provide this capacity. The work to restore the 7,000 cfs capacity is a requirement of the existing Merced County Streams Group Project, and therefore the costs are not considered attributable to the modifications project; however, prior to construction, the State will be required to accomplish the work necessry to provide this capacity or present data verifying a capacity of 7,000 c.f.s.

In accordance with the local cooperation requirements for the modifications to the Merced County Stream Group Project authorized in 1970, local interests are required to restore and thereafter maintain various stream flow capacities throughout the Bear Creek basin, including 400 cfs in Canal Creek between Black Rascal Slough and Livingston Canal, and 800 cfs in Canal Creek between Livingston Canal and Castle Dam. The existing capacity of Canal Creek upstream of Livingston Canal is greater than 800 cfs, and for that matter, summer irrigation flows in this reach of Canal Creek exceed 800 cfs. The capacity of Canal Creek between Black Rascal Slough and Livingston Canal is approximately 400 cfs.

CORPS OF ENGINEERS

U.S. ARMY

OPERATION AND MAINTENANCE MANUAL
FOR
CHANNELS AND LEVEES OF THE
MERCED COUNTY STREAM GROUP

U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
June 1962

Revised March 1984

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Sacramento District
Corps of Engineers
U.S. Army
March 1984

This manual supersedes the Operation and Maintenance Manual issued June 1962.

OPERATION AND MAINTENANCE MANUAL
FOR CHANNELS AND LEVEES
OF THE
MERCED COUNTY STREAM GROUP

SECTION I

INTRODUCTION

1-01 Project Authorization and Location. The diversion channels of Black Rascal Creek to Bear Creek and Owens Creek to Mariposa Creek and channels as cleared by local interests were authorized as units of the plan of improvement for flood protection streams in the Merced County Stream Group in San Joaquin Valley, California in the Flood Control Act of 1944. The authorization was based on a report titled "Merced County Streams, California" printed in House Document No. 473, 78th Congress, 2nd Session. The diversion channel between Black Rascal Creek and Bear Creek is located about 4 miles east of the city of Merced in central California and is approximately 1.9 miles long. The diversion channel between Owens Creek and Mariposa Creek is located about 11 miles southeasterly of the city of Merced and is about 1.7 miles long. A location map is shown as Exhibit A.

The streams comprising the Merced County Stream Group rise in the Sierra Nevada foothills of the Central Valley of California and flow in a westerly direction to join the San Joaquin River west of the city of Merced. The streams form two groups: Bear Creek with its tributaries, Black Rascal, Canal, Fahrens, and Burns Creek; and Mariposa Creek with its tributaries, Miles and Owens Creeks.

1-02 Description of Project Works. - The project works was designed to protect about 136,000 acres of agricultural land, the City of Merced and the communities of Planada and Le Grand. During the irrigation season some channels are used for drainage and other channels for irrigation purposes. A freeboard of at least 3 feet above the project flood plane has been provided on levees constructed for this project.

a. Channels:

(1) The Black Rascal Diversion Channel with levees on both banks is about 10,000 feet in length and has a 3,000 cfs channel capacity.
1.9mi.

(2) The Owens Creek Diversion Channel with levees along both channel banks is approximately 8,900 feet long and has a 400 cfs channel capacity.
1.7mi

(3) Enlargement of Miles Creek to provide a channel capacity of 1,000 cfs from section line common to Sections 25 and 26, T 7 S, R 15 E to State Highway 59. 33" — 12.5mi

(4) Burns Creek: The flow capacity of Burns Creek is to be 2,000 cfs from its confluence with Bear Creek upstream to the Burns Creek reservoir dam outlet. 4"(channel on Exh. H) – 1.5mi

(5) Bear Creek: the flow capacity must not be less than 3100 cfs from the confluence at the lower end of Black Rascal Slough upstream to the head of Black Rascal Slough; then 7000 cfs upstream to Black Rascal Diversion channel; then 4000 cfs upstream to the confluence of Burns Creek; then 2000 cfs upstream to the Bear Creek reservoir outlet. 62"(channel on Exh. H) – 23.5mi

(6) Black Rascal Slough: The flow capacity must not be less than 3900 cfs so that the combined capacity of Black Rascal Slough and Bear Creek is not less than 7000 cfs. 19" – 7.2mi

(7) Owens Creek: The flow capacity must be 400 cfs from the Owens Creek Diversion Channel to the bridge crossing at the section line common to Sections 29 and 30, T 7 S, R 16 E, and then 250 cfs upstream to the Owens Creek reservoir outlet. 7"(channel on Exh. H) – 2.7mi

(8) Mariposa Creek: The flow capacity must not be less than 1250 cfs from State Highway 59 upstream to the Owens Creek Diversion Channel; then 1000 cfs upstream to the Mariposa Creek reservoir dam outlet. 46"(channel on Exh. H) – 17.4mi

b. Gaging Stations:

(1) Pool stage recorders and outflow gaging stations on the dams and on the streams downstream of the dams on Burns, Bear, Owens and Mariposa Creeks.

(2) Stream flow gaging stations at both diversion channels of Black Rascal and Owens Creeks and a stream flow gaging station on Bear Creek at McKee Road.

c. Dams: The construction of 4 dams, one each on Burns, Bear, Owens, and Mariposa Creeks to retain uncontrolled flows in the reservoirs and to provide the following flow releases:

(1) Burns Creek: The reservoir on this creek has a gross pool elevation of 300 feet, NGVD, and an outlet works consisting of two ungated conduits with a combined outlet capacity of 1800 cfs.

(2) Bear Creek: The reservoir on this creek has a gross pool elevation of 413.5 feet, NGVD, and an outlet works consisting of two ungated conduits with a combined outlet capacity of 1800 cfs.

(3) Owens Creek: The reservoir on this creek has a gross pool elevation of 407.5 feet, NGVD, with an ungated conduit for its outlet works with an outlet capacity of 185 cfs.

(4) Mariposa Creek: The reservoir on this creek has a gross pool elevation of 439.5 feet, NGVD, with two ungated conduits for its outlet works with an outlet capacity of 1000 cfs.

1-03. Purpose of Manual. This manual has been prepared to provide local interests with information pertinent to the operation and maintenance of the project facilities and to assure that structures and facilities provided by the United States for local flood protection are continuously maintained and operated as necessary to obtain maximum benefits. Rules that govern local interests in operating and maintaining flood control projects are contained in the Code of Federal Regulations. (See Exhibit B). The Flood Immunity Statute (33 U.S.C., Section 701c.) protects the United States from liability of any kind from damage caused by floodwater related to a flood control protect.

1-04. Definitions. Definitions applicable to this manual are:

District Engineer: The chief executive of the Sacramento District, U.S. Army Corps of Engineers, 650 Capitol Mall, Sacramento, 95814. In certain contexts, the term may be construed to include representatives of the District Engineer.

Regulations: Part 208, Chapter II, Title 33, Code of Federal Regulations. (Exhibit B of this manual is an extract.)

Right or left bank: The right or left side of a stream or waterway as the viewer faces downstream.

Superintendent: The local official with responsibility (pursuant to regulations) for developing and maintaining, and directly in charge of, an organization charged with the efficient operation and maintenance of flood control facilities provided by the United States.

1-05. Flood Flows. For purposes of this manual, the term "Flood" or "high water period" shall refer to flows when the water surface reaches or exceeds the following:

a. A reading of 14.0 on the gage located on the left bank of Bear Creek at McKee Road.

b. A reading of 8.0 on the gage located on the left bank of the Black Rascal Creek Diversion channel at Yosemite Avenue.

c. A reading of 5.0 on the gage located on the right bank of Owens Creek Diversion Channel at Mission Avenue.

1-06. Construction Data and Contractor. Construction contracts required by the U.S. Army Corps of Engineers to complete the project works as described under paragraph 1-02 of this manual were as follows:

a. Construction of the diversion channels, Black Rascal Creek to Bear Creek and Owens Creek to Mariposa Creek and Gaging Stations was accomplished under Contract No. DA-04-167-ENG-1376 by the Stockton Construction Company and completed on 13 April 1956. Dwgs # ME-6-3-7 (Owens Cr Div) and ME-8-3-9 (Black Rascal Div.) and ME-25-22 (Stream Gaging Stations) Note: Crown of R.B. levee of Black Rascal Cr upstream from Yosemite Ave was not surfaced with gravel (see ME 8-3-9).

b. Construction of gaging stations near the dams on Burns, Bear, Owens and Mariposa reservoir, Black Rascal and Owens Creek Diversion canals and on Bear Creek at McKee Road, was accomplished under various contracts as listed in the individual operation and maintenance manuals for the reservoir dams.

c. Construction of the dams on Burns, Bear, Owens and Mariposa Creeks was accomplished by various contractors, to retain uncontrolled flows in the reservoirs. For details see individual dam, operation and maintenance manuals.

SECTION II

LOCAL COOPERATION

2-01. Stated Requirements. - House Document No. 473 recommended construction of the Merced County Stream Group Project upon condition that the State of California or other responsible local interests:

(a) provide without cost to the United States all lands, easements and rights-of-way necessary for the construction;

(b) bear the expense of all necessary highway and utility changes;

(c) complete the enlargement of the channel of Miles Creek and restore the channel capacities of Black Rascal, Burns, Bear, Owens and Mariposa Creeks in accordance with the plan of the District Engineer;

(d) hold and save the United States free from damages resulting from construction of the works; and

(e) except for the reservoirs, dams, and appurtenant gages, maintain and operate the completed project works and existing channels in accordance with regulations prescribed by the Secretary of the Army.

2-02. Assurances Provided by Local Interests. - Section 12650 of the California State Water Code (added by Section 1, Chapter 196 and amended by Section 1, Chapter 1118 of the California Statues of 1959) adopted and authorized the Merced County Stream Group Project.

Assurances of local cooperation by the State Reclamation Board are contained in Section 12657, which reads in part:

> .....the Reclamation Board shall give assurances satisfactory to the Secretary of the Army that the local cooperation, required by Section 3 of the Act of Congress approved December 22, 1944 (Public Law 534, 78th Congress, 2nd Session), and Section 2 of the Act of Congress approved August 18, 1941 (Public Law 228, 78th Congress, 1st Session), will be furnished by the State in connection with the local flood control project authorized and adopted in . . .Section 12650.

Merced and Mariposa Counties are involved in the requirements for local interests to enact and enforce flood zoning from a point just downstream of Burns, Bear, Owens and Mariposa dams to various points downstream. See Exhibit A for the limits of the upstream and downstream points of local responsibility.

2-03. Transfer of Responsibility. - Responsibility for operating and maintaining the completed works was officially transferred to the State Reclamation Board by letter dated 8 September 1956, as shown on the inclosed letter of transfer, Exhibit C.

SECTION III

MAINTENANCE AND OPERATION

3-01. Introduction. - This manual has been prepared to furnish local interests with information on the project works and to provide advice regarding the requirements of operation and maintenance. The project works are to be maintained and operated in accordance with the Regulation shown as Exhibit B and the interpretations and amplifications thereof as contained herein.

3-02. Responsibilities of the Superintendent. - A general outline of the responsibilities of the Superintendent is contained in Section 208.10, Sub-section (a) of the Regulations. Subparagraph (2) is an overview of these responsibilities. It reads:

> 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 the 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.

Major specific duties of the Superintendent are:

a. Training Key Personnel. - Key personnel of the maintenance and operation organization and an Assistant Superintendent should be trained to handle maintenance as well as unexpected problems related to flood control. Sector foremen should be trained to lead in patrol, inspection of channels, operation of gate structures, and maintenance work so these functions will be handled in an orderly and expeditious manner.

b. Preventing Encroachment and Trespass. - Project right-of-way should be posted with clearly visible signs to prevent encroachment or trespass of project facilities. The Superintendent will take action under local ordinances and authorities to prosecute trespassers or remove unauthorized encroachments, and make a written report to the State Reclamation Board on any actions taken.

c. Permits for Right-of-Entry or Use of Right-of-Way. - Permits for temporary right-of-entry upon, or the use of portions of project right-of-way, shall not be issued until the State Reclamation Board determines the conditions to be included in the permit document. The Superintendent will, therefore, cause notices to be posted at conspicuous locations along the project right-of-way to direct public attention to this requirement. See Exhibit D for a sample permit.

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

(1) That all work be performed in accordance with standard engineering practice using plans and specifications approved by the District Engineer or his authorized representative.

(2) That drawings of proposed improvements or alterations of existing flood control works be submitted to the State Reclamation Board in advance of the start of construction to permit adequate study and consideration.

(3) That proposed work be determined compatible with existing project improvements.

(4) That after completion of the improvement or alteration, "As Constructed" drawings be submitted to the District Engineer in duplicate.

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

f. Inspection. - The Superintendent must make periodic inspections to insure that effective maintenance is continuing. Regulations provide that such inspections shall be made just before the beginning and at the end of the flood season; immediately after each high water period, otherwise at intervals not exceeding 90 days; and at such intermediate times as necessary to insure the best possible care of project facilities. The flood season is deemed to extend from 1 November through 1 May. The suggested check list shown as Exhibit E should be followed to insure that no feature of the project works is overlooked during inspections.

g. Maintenance. - It is the responsibility of the Superintendent to maintain project facilities in a manner that ensures their serviceability during periods of flooding. Maintenance and repair shall be accomplished during the appropriate season as scheduled by the Superintendent. Immediate steps will be taken to correct dangerous conditions disclosed by inspections.

The Superintendent is fully responsible for making repairs and selecting the methods used. The District Engineer will be available for advice and consultation. All repairs shall be made in accordance with standard

engineering practice, to line and grade, and in accordance with details shown on the construction drawings for the project works (Exhibit F). No change or alteration shall be made in any feature of the project works without a prior determination by the District Engineer that such alteration will not adversely affect the stability and functioning of project facilities. Plans and specifications for all proposed changes or alterations shall be submitted to the District Engineer through the State Reclamation Board for investigation and approval before prosecution of the work.

In the event that damage to the project works, whether due to flooding or other causes, is considered to be beyond the maintenance responsibility of the local interests to repair, the Superintendent will contact the District Engineer, through the State Reclamation Board, and he will assist, advise, or suggest the course of action to be taken.

h. Protecting the Environment. - Project maintenance is to be accomplished in a manner that minimizes adverse environmental impact. Dead trees with wildlife value will be retained except where they constitute a hazard to project works.

i. Maintaining Records and Making Reports. - The Superintendent must maintain files of records, drawings, and reports on the project works and make these data available to the District Engineer upon request. The Superintendent shall submit a semi-annual report to the District Engineer within a 10-day period following 30 April and 1 November. The report will comprise statements of:

(1) The physical condition of the protective works as summarized from logs of inspection.

(2) Flood-fighting activities during the report period and the behavior of the project works during floods.

(3) Prosecutions for encroachment or trespass.

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

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

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

(7) The cost of maintenance and operation for the report period.

(8) Any unusual, abnormal, or unexpected conditions or occurrences bearing on the stability or continued effectiveness of the project works.

A suggested form for submitting the semi-annual report is shown as Exhibit G. Copies of inspector's field notes as recorded on a check-list (Exhibit E) will be made an inclosure to the semi-annual report.

3-03. Assistance by the District Engineer. - To assist the Superintendent in meeting responsibilities under the Regulations, the District Engineer will:

a. Furnish "As Constructed" drawings of project works to the local interests responsible for maintenance and operation of project works. (Exhibit F.)

b. Make periodic inspections of the project works and notify local interests of any repairs or maintenance measures deemed necessary in addition to measures taken and repairs made by the Superintendent.

c. Submit detailed reports on all cases of non-compliance with the Regulations to the Chief of Engineers for determination of corrective measures.

d. Make a prior determination of the effect of any proposed alteration of project works (or encroachment, excavation, or construction within the project right-of-way) on project functioning and furnish the results to the Superintendent in writing.

3-04. Specific Maintenance and Operation Requirements. - The requirements for maintaining and operating (1) local flood protection works; (2) levees, and (3) channels and floodways are contained in paragraphs 208.10(a), 208.10(b) and 208.10(g) respectively of the Federal Regulations, dated 16 August 1944 (Title 33). See Exhibit B for a more complete listing of the requirements for the above flood control facilities.

(1) General: The requirements for maintaining and operating local flood protection works are contained in paragraph 208.10(a) of the Regulations, which are quoted in part as follows:

> .....The structures and facilities constructed by the United States for local flood protection shall be continuously maintained and operated as may be necessary to obtain maximum benefits.
>
> * * * * * * * * * *
>
> A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.
>
> * * * * * * * * * *
>
> 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 of the protective facilities.
>
> * * * * * * * * * *
>
> No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of

the project right-of-way, nor shall any change be made in any features of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities.

* * * * * * * * * *

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

* * * * * * * * * *

(2) Levees: The requirements for maintaining and operating levees are contained in Paragraph 208.10(b) of the Regulations, which are quoted in part as follows:

.....Periodic inspections shall be made by the Superintendent to insure that the maintenance measures are being effectively carried out and, further, to be certain that:

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

* * * * * * * * * *

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

* * * * * * * * * *

No seepage, saturated areas, or sand boils are occurring; Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

* * * * * * * * * *

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

* * * * * * * * * *

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

* * * * * * * * * *

Cattle guards and gates are in good condition.

* * * * * * * * * *

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

* * * * * * * * * *

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

* * * * * * * * * *

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...."

(3) Channels and Floodways: The requirements for maintaining and operating channels and floodways are contained in paragraph 208.10(g) of the Regulations, which are quoted in part as follows:

.....Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

* * * * * * * * * *

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

* * * * * * * * * *

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

Riprap sections and deflection dikes and walls are in good condition;

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.

* * * * * * * * * *

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 structure repaired.

* * * * * * * * * *

a. Periodic Inspections. - The State Department of Water Resources will make a detailed inspection of the project in the spring and fall of each year and note any required maintenance. Inspections are to be scheduled to coincide with the beginning and end of the flood season (1 November and 30 April), and the check list shown as Exhibit E is to be used. The purpose of these and other periodic inspections is to insure that conditions that may impair the effectiveness of the project are not developing. It is intended that inspections disclose all conditions that in any way affect the stability and functioning of the structures. Particular attention will be given to the following during every inspection:

1. Location, extent, and size of vegetation.

2. Unauthorized operations such as excavation or construction of buildings and other structures, levees, bank protection, or training dikes within the floodflow channel right-of-way.

3. Deposition of rubbish of any sort and disposal of industrial waste.

4. Changes such as aggradation or degradation in the streambed, which could interfere with free flow from side drainage structures or induce local meanders that would scour the banks.

5. Upstream operations of any nature that would affect flow conditions in the project reach.

6. The condition of project facilities.

During inspections, it should be determined whether the following provisions of the Regulations are being adhered to:

1. That all brush, trees and wild growth other than sod are removed from the levee crown and slopes.

2. That all grass and weeds on the levee have been mowed where removal by other methods such as burning is dangerous or impracticable. This especially applies to peat levees where burning would constitute a hazard to improvements.

3. That all burrowing animals have been exterminated.

4. That all caves, sloughs, burrows, holes, slips or other damaged portions of the levee have been repaired.

5. That all irrigation and drainage structures through the levee are in good working condition.

6. That no revetment work or riprap has been displaced, washed out or removed.

7. That the crown of the levee is well shaped and maintained and that unauthorized vehicular travel is restricted.

8. That stock grazing on the levee is restricted to conditions and seasons when the levee would not be seriously scarred or otherwise damaged thereby.

9. That encroachments are not being erected on the levee which would hinder travel by authorized patrol vehicles.

10 Prevent the erection of structures on, additions to, or alterations of the levee unless authorized by permit from the State Reclamation Board.

b. Special Instructions, Maintenance. The principle features of the project consists of two diversion channels with levees and the enlargement of existing channels and floodways. Accordingly, the requirements of paragraphs 208.10(b) and (c) are supplemented as follows:

1. Where shoaling or aggradation at the inlets or outlets of side structures make them inoperative, it is imperative that all drains be kept open and unobstructed at all times.

2. 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.

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

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

5. Weeds and other vegetal growth in the channel shall be cut in advance of the flood season and removed from the channel with all debris.

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

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

8. 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 cleared so that they swing freely to a true closure. If any parts of the gates have been damaged or broken, they shall be replaced with new parts.

9. 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.

10. In the event that it becomes necessary to fill any of the levee, care should be taken not to bury any of the side drainage inlets. Plans for the maintenance of drainage facilities at any such points should be submitted to the State Reclamation Board for approval before such work is started.

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

c. Drainage and Irrigation Structures.

Description. Drainage and irrigation structures which extend through the levees are listed as follows:

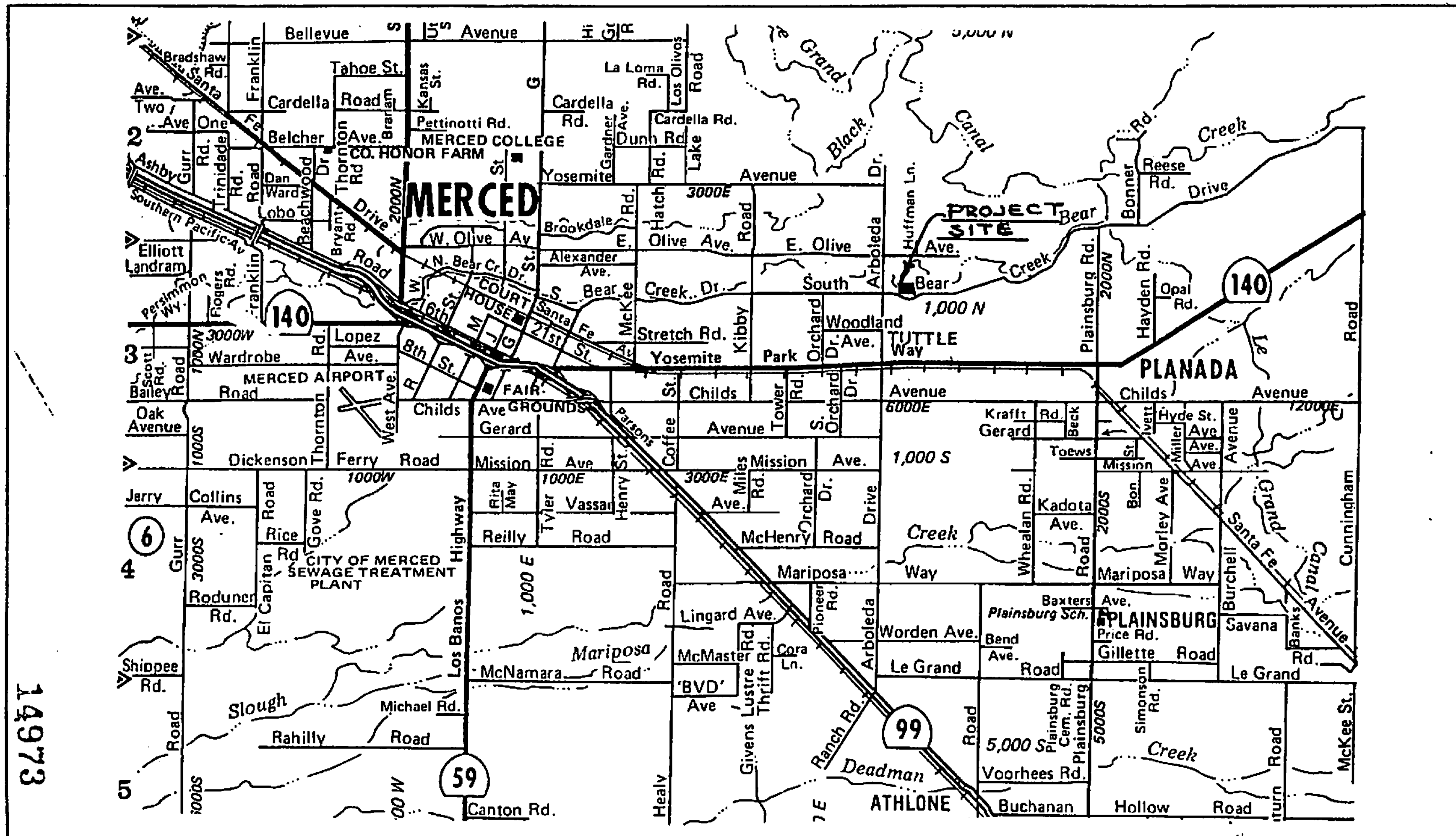
Levee Mile	Size of Pipe	Other Description	Invert Feet Below Crown
Unit No. 1 - Black Rascal Creek Diversion Channel - Right Bank			
0.00	6' x 6' Concr.	Inverted siphon under channel	----
1.32	36" CMP	Riser unit L-S	10.0
Unit No. 2 - Black Rascal Creek Diversion Channel - Left Bank			
0.00	10" Steel	Riser unit L-S	5.0
0.29	24" CMP	Flap gate W-S	8.0
0.54	24" CMP	Flap gate W-S	12.0
0.73	24" CMP	Flap gate W-S	8.0
0.91	2 - 60" CMP	Flap gate W-S	10.0
1.32	24" CMP	Flap gate W-S	10.0
1.64	24" CMP	Flap gate W-S	8.0
Unit No. 1 - Owens Creek Diversion Channel - Right Bank			
0.00	Concr., size unknown	Inverted siphon under channel	----
0.18	24" CMP	Flap gate W-S	6.0
0.39	24" CMP	Flap gate W-S	10.0
0.59	24" CMP	Flap gate W-S	7.5
0.80	24" CMP	Flap gate W-S	6.5
1.04	24" CMP	Flap gate W-S	5.0
1.17	24" CMP	Flap gate W-S	6.0
1.29	24" CMP	Flap gate W-S	4.0

Levee Mile	Size of Pipe	Other Description	Invert Feet Below Crown
Unit No. 2 - Owens Creek Diversion Channel - Left Bank			
0.10	24" CMP	Flap gate W-S	5.0
0.17	24" CMP	Flap gate W-S	6.0
0.31	24" CMP	Flap gate W-S	6.0
0.45	24" CMP	Flap gate W-S	5.0
0.58	24" CMP	Flap gate W-S	6.0
0.82	24" CMP	Flap gate W-S	6.0
1.02	24" CMP	Flap gate W-S	8.0
1.08	24" CMP	Flap gate W-S	10.0
1.24	24" CMP	Flap gate W-S	10.0

Note on abbreviations:
CMP = Corrugated Metal Pipe
W-S = Waterside
L-S = Landside

EXHIBIT A

VICINITY MAP



PREPARED FOR: WARREN LOCKWOOD	BEDESEN-CARDOZA-ANDREWS, INC. Civil Engineering-Land Surveying 301 W. 18 St., P.O. Box 391 Merced, California 95341 (209) 722-8042	~~SITE LOCATION MAP FOR BEAR CREEK [illegible] WARREN LOCKWOOD~~

DESIGN / DRAWN / CKD. / ENG./CONST. / PROJ. ENG. / SCALE / APPROVED / BY / DATE / REVISIONS

○ OF ○

JOB NO. ______
F.B. NO. ______

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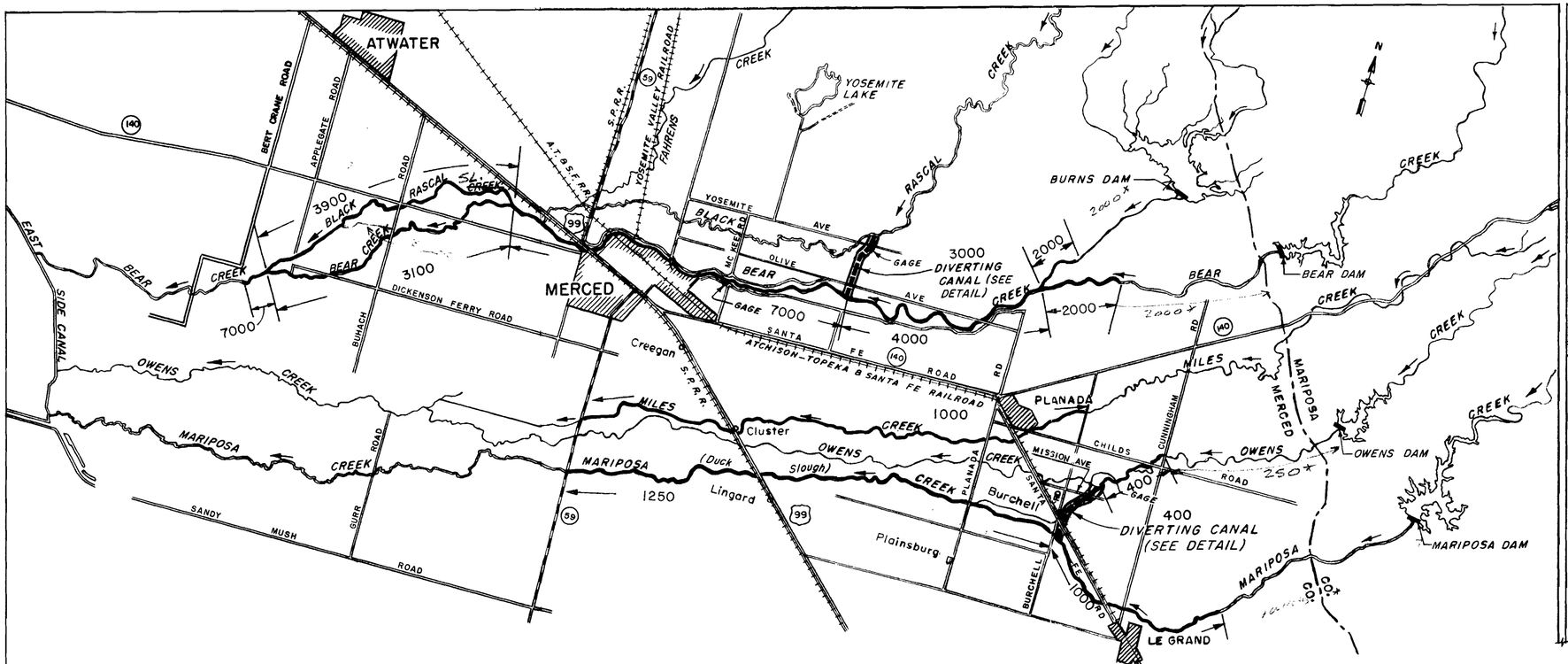


VICINITY MAP

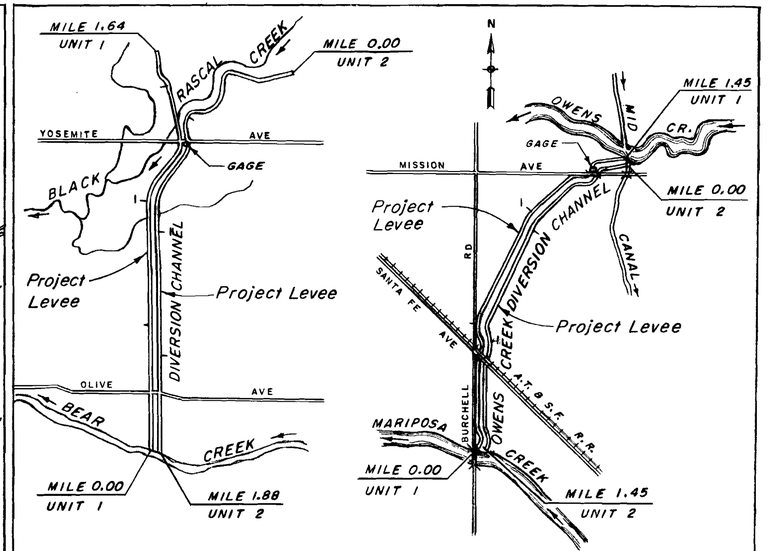
SCALE IN MILES

1 0 1 2 3 4

* See pg. 2

LEGEND

- Extent of Channels with Levee Maintained by Local Interest
- Channels Maintained by Local Interest
- cfs — Project Capacities
- Dam and Reservoir Maintained by Corps



DIVERSION CHANNEL DETAIL

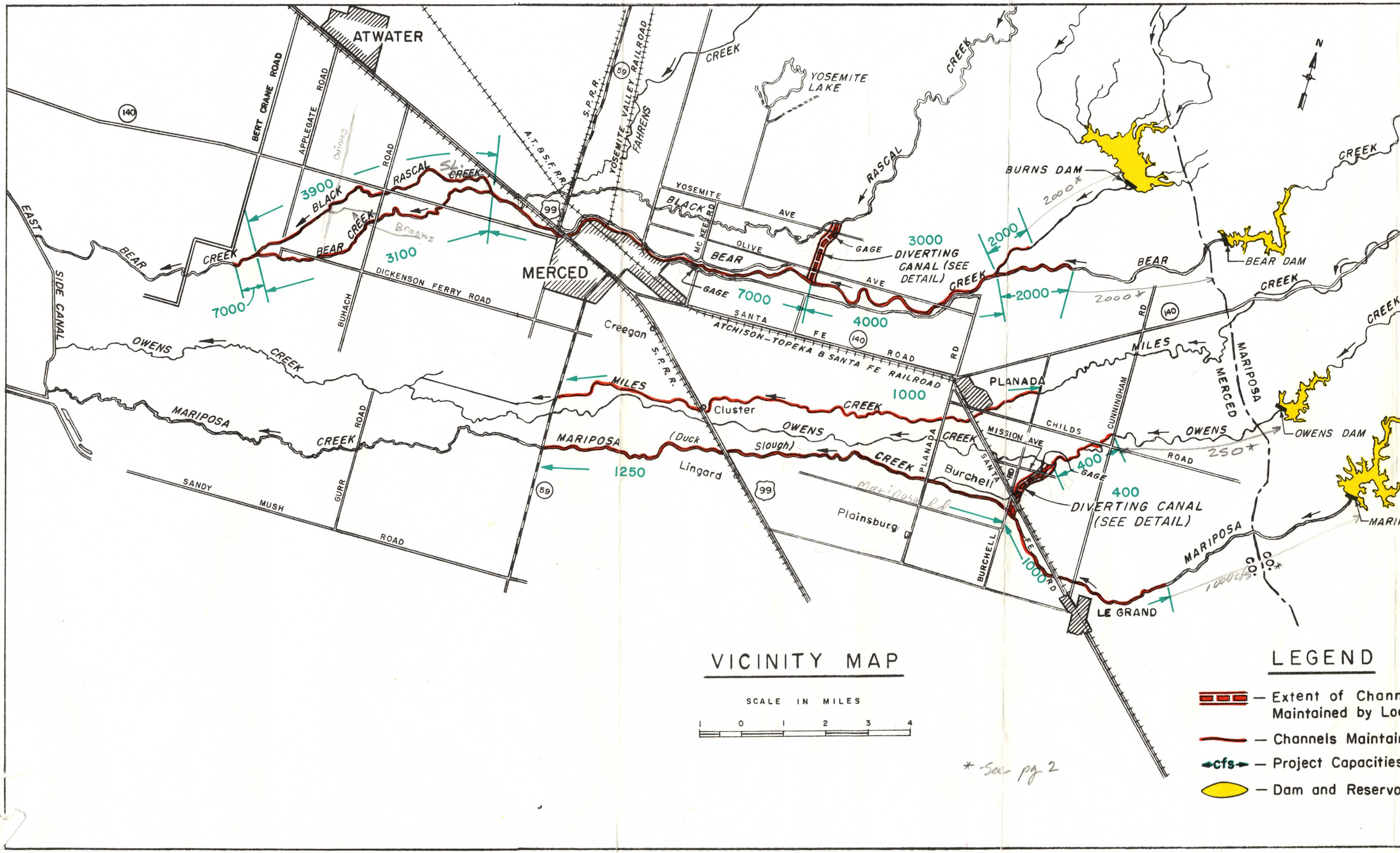
SCALE IN MILES

0 1/2 1

LOCATION MAP

MERCED COUNTY STREAM GROUP,
CALIFORNIA
FLOOD CONTROL PROJECT
CHANNELS AND LEVEES

EXHIBIT A



VICINITY MAP

SCALE IN MILES

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LEGEND

— Extent of Chann
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— Channels Maintai

cfs — Project Capacities

— Dam and Reserva

* See pg 2

CODE OF FEDERAL REGULATIONS (EXTRACT)

TITLE 33 – NAVIGATION AND NAVIGABLE WATERS

Chapter II – Corps of Engineers, Department of the Army

PART 208 – FLOOD CONTROL REGULATIONS

AUTHORITY: § 208.10 issued under Sec. 7, 58 Stat. 890; 33 U.S.C. 709.

§ 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 the 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.

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

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

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army 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 Department of the Army 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 this part.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(iv) The concrete has not undergone cracking, chipping, or breaking to an extend 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*

EXHIBIT B
Sheet 1 of 2

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. (Sec. 3, 49 Stat. 1571, as amended; 33 U.S.C. 701C) [9 F.R. 9999, Aug. 17, 1944; 9 F.R. 10203, Aug. 22, 1944]

EXHIBIT B
Sheet 2 of 2

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8 September 1956

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

Gentlemen:

Reference is made to District Engineer's letter dated 25 November 1955 suggesting a joing inspection of the Merced County Stream Diversion Channels, for the purpose of transferring them to the jurisdiction of the State of California for operation and maintenance. Reference is also made to the joint inspections of these diversion works on 29 November 1955 and 12 April 1956. The location and description of work of these units are described as follows:

Unit No.	Location and Description of Work
1	Diversion Channel, approximately 9,918 feet in length from Black Rascal Creek to Bear Creek, Sta. 28 + 18 to 71 + 00, Drawing No. ME-8-3-9.
2	Diversion Ditch, approximately 1,850 feet in length with its head at Sta 16 + 45 and connecting with Black Rascal Creek Diversion Channel at Sta. 1 + 40, Drawing No. ME-8-3-9.

Unit No.	Location and Description of Work
3	Levee along the left bank of Black Rascal Creek Diversion Channel, approximately 10,070 feet in length from Sta. - 31 + 40 to 69 + 30, Drawing No. ME-8-3-9.
4	Levee along the right bank of Black Rascal Creek Diversion Channel, approximately 7,030 feet in length, from Sta. - 1 + 00 to 69 + 30, Drawing No. ME-8-3-9.
5	Levee along the left bank of Owens Creek Diversion Channel, approximately 6,780 feet in length, from Sta. 20 + 00 to 87 + 80, Drawing No. ME-6-3-7.
6	Diversion Channel, approximately 8,780 feet in length, from Owens Creek to Mariposa Creek, Sta. 0 + 00 to 87 + 80, Drawing No. ME-6-3-7.
7	Levee along the right bank of Owens Creek Diversion Channel, approximately 8,750 feet in length, from Sta. 0 + 00 to 87 + 50, Drawing No. ME-6-3-7.

The work referred to above was completed on 13 April 1956, in accordance with Specification No. 1930, under Contract No. DA-04-167-eng-1376 and Drawing No. ME-8-3-9, ME-6-3-7 and ME-13-61, and meets with the requirements of the Flood Control Project for the improvement of the Merced County Stream Group which is covered in House Document No. 473, 78th Congress, 2nd Session, approved by the Flood Control Act of 22 December 1944. Therefore, said units of work, Nos. 1 to 7 inclusive, are hereby transferred to the State of California for operation and maintenance.

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

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

Sincerely yours,

LEON J. HAMERLY
Lt. Col., CE
Acting District Engineer

1 Incl
1 F.C. Reg.

EXHIBIT C
Sheet 3 of 3

EXHIBIT D

SAMPLE RIGHT-OF-ENTRY PERMIT

PERMITS FOR USE OF RIGHTS-OF-WAY

LOCAL FLOOD PROTECTION PROJECTS

Improvements for local flood protection and the associated rights-of-way are owned by the local interests concerned, and are operated and maintained by them in accordance with the Code of Federal Regulations. (See Exhibit B.) Paragraph 208.10a(5) of Exhibit B provides that permits for use of the right-of-way of flood control projects so owned, operated, and maintained are subject to the approval of the District Engineer.

Applications for use of flood control project right-of-way should be addressed to the local interests having jurisdiction. The local interests will forward the application to the District Engineer together with recommendations and the reasons therefor. It is suggested that a draft copy of the permit be included with the application and recommendations so any objectionable features of the permit can be eliminated prior to offering it to the applicant. If the local interests wish to forward a permit without the application and recommendations, five copies should be submitted. The proposed permit should state the exact use of right-of-way for which permission is being requested and express any conditions or restrictions that apply. It should be signed by the applicant and a representative of the local interests having jurisdiction. A drawing, sketch, or detailed plan as may be required to show the exact location, nature of the work to be permitted, and the proposed method of its execution should be attached to each copy of the proposed permit. If the permit is approved by the District Engineer, three copies will be returned to the local interests concerned.

If the use proposed by an applicant could result in damage to the right-of-way or associated flood control structures, it is suggested that the applicant be required to post a bond to protect the local interests from any costs for removal, repair, or restoration, and to guarantee that the permitee faithfully meets conditions imposed by the approved permit. In such cases, the permit would state the amount and conditions of the bond.

In cases involving major construction or other work that may directly affect flood protection structures, it will be necessary that the District Engineer or his representative inspect the work. Local interests may also wish to make inspections. As stated in the permit form, such inspection will be at the expense of the grantee, and this should be called to his attention. Except in cases of known financial secutiry, arrangements should be make with the grantee for an advance deposit or bond to cover inspection costs.

A permit format that has been utilized by a number of cities and levee commissions is attached.

PERMIT

FOR

RIGHT OF ENTRY

_____
(Name of local interest having jurisdiction)

_____
(Location)

Permission is hereby granted to:

_____ _____
(Name of firm or individual) (Address)

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

_____

_____

_____

_____

PROVIDED THAT:

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

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

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

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

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

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

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

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

_____

_____

_____

_____

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

Signature (Grantor)	Title	Date

Terms of this permit are hereby accepted:

Approved:

Signature (Grantee)	Date	District Engineer	Date

EXHIBIT E

SUGGESTED CHECK LIST OF LEVEES, CHANNELS AND STRUCTURES

For definition of "flood" or "high water period"
See paragraph 1-05 of this manual.

CHECK LIST NO.

MERCED COUNTY STREAM GROUP

LEVEES AND CHANNEL IMPROVEMENT

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendent _____

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

INSTRUCTIONS FOR COMPLETING SHEET 2, EXHIBIT E

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

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

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

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

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

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

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

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

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

CHECK LIST NO.

MERCED COUNTY STREAM GROUP

LEVEES AND CHANNEL IMPROVEMENT

Inspector's Report Sheet No. ___ Inspector _____

Date _____ Superintendent _____

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

INSTRUCTIONS FOR COMPLETING SHEET 4, EXHIBIT E

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

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

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

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

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

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

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

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

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

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

SUGGESTED CHECK LIST NO.

DRAINAGE AND IRRIGATION STRUCTURES

MERCED COUNTY STREAM GROUP

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendant _____

(a) Location by levee mileage	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of-way adjacent to structure	(g) Repair Measures taken since last inspection	(h) Comments
0.00	Rt.	Unit No. 1 - Black Rascal Diversion Channel					
1.32	Rt.						
		Unit No. 2 - Black Rascal Diversion Channel					
0.00	Lt.						
0.29	"						
0.73	"						
0.91	"						
1.32	"						
1.64	"						

EXHIBIT E
Sheet 6 of 8

SUGGESTED CHECK LIST NO.

DRAINAGE AND IRRIGATION STRUCTURES

MERCED COUNTY STREAM GROUP

Inspector's Report Sheet No. _____ Inspector _____

Date _____ Superintendent _____

(a) Location by levee mileage	(b) Bank	(c) Debris or other obstruction to flow	(d) Damage or settlement of pipe or conduit	(e) Condition of concrete headwall or invert paving	(f) Condition of right-of-way adjacent to structure	(g) Repair measures taken since last inspection	(h) Comments
			Unit No. 1 - Owens Creek Diversion Channel				
0.18	Rt.						
0.40	Rt.						
0.59	Rt.						
0.80	Rt.						
1.04	Rt.						
1.17	Rt.						
1.29	Rt.						
			Unit No. 2 - Owens Creek Diversion Channel				
0.10	Lt.						
0.17	Lt.						
0.31	Lt.						
0.45	Lt.						
0.58	Lt.						
0.82	Lt.						
1.02	Lt.						
1.10	Lt.						
1.24	Lt.						

INSTRUCTIONS FOR COMPLETING SHEETS 6 AND 7, EXHIBIT E

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

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

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

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

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

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

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

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

EXHIBIT F

"AS CONSTRUCTED DRAWINGS"

(See separate folder for the following drawings)

FILE NO	
ME-6-3-7	Diversion Channel, Owens Creek to Mariposa Creek, in 4 Sheets.
ME-8-3-9	Diversion Channel, Black Rascal Creek to Bear Creek, in 5 Sheets.
ME-25-22	Stream Gaging Stations, in 2 Sheets.

EXHIBIT G

SEMI-ANNUAL REPORT FORM

TO: The District Engineer (30 Apr 19___)
U. S. Army Engineer District, Sacramento (1 Nov 19___)
Federal and Courts Building
650 Capitol Avenue
Sacramento 14, California

Dear Sir:

The semi-annual report for the period (30 Apr 19____ to 31 Oct 19___) (1 Nov 19___ to 29 Apr___) Merced County Stream Group Project Levee and Channel Improvements, Merced County, is as follows:

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

(Superintendent's summary of conditions)

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

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

b. During this report period, major high water periods (water surface in Bear Creek reached or excedded the gage readings of 14.0; Black Rascal Creek Diversion Channel at Yosemite Ave. 8.0; Owens Creek Diversion Channel at Mission Ave. 5.0)occurred on the following dates:

Dates	Maximum Elevation
_____	_____
_____	_____
_____	_____
_____	_____

EXHIBIT G
Sheet 1 of 2

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

(Superintendent's log of flood observations)

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

(See Maintenance Manual for Merced County Stream Group)

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

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

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

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

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

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

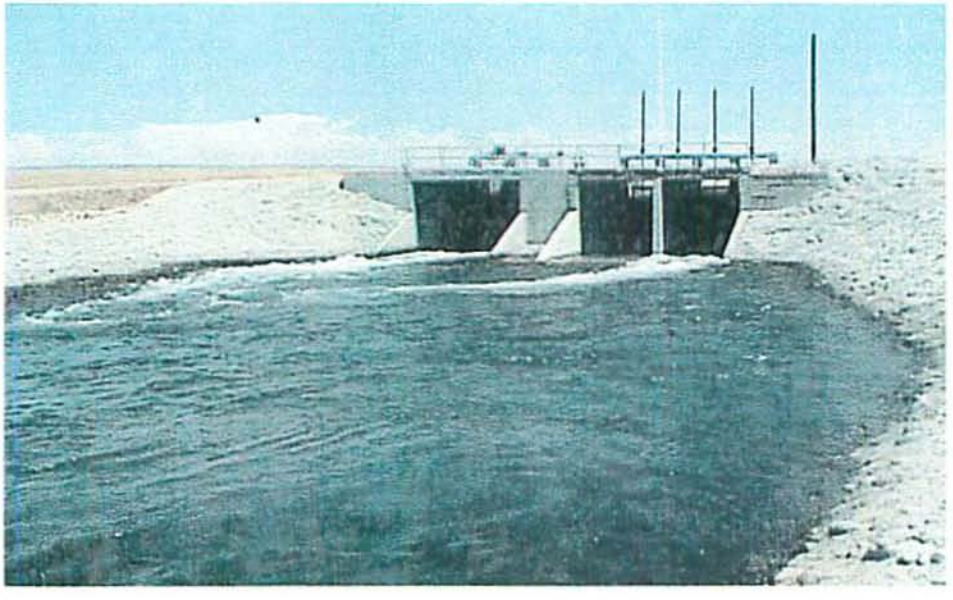
	Labor	Material	Equipment	Overhead	Total
1. Inspection					
2. Maintenance					
3. Flood Fighting Operations					
TOTAL					

Respectfully submitted,

_____
Superintendent of Works

CASTLE DAM AND RESERVOIR
MERCED COUNTY STREAMS GROUP
MERCED COUNTY, CALIFORNIA

FINAL
OPERATIONS AND MAINTENANCE MANUAL



US ARMY CORPS
OF ENGINEERS
Sacramento District

January 2000

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
333 Market Street, Room 923
San Francisco, California 94105-2195

REPLY TO
ATTENTION OF:

APR 19 2000

CESPD-PM

MEMORANDUM FOR Commander, Sacramento District, ATTN: CESPK-PM

SUBJECT: Castle Dam and Reservoir, Merced County Streams Group, Merced County California

The Operations and Maintenance Manual for the Castle Dam Unit of the project which includes Castle Dam and Reservoir, the check structure within Main Canal, the Canal Creek, Edendale Creek and Fahrens Creek Turnout Structures is hereby approved. For further questions on this matter please contact Mr. George W. Domurat (CESPD-PM) at 415-977-8050.

FOR THE COMMANDER :

GEORGE W. DOMURAT
Sacramento District Support Team

CASTLE DAM AND RESERVOIR
MERCED COUNTY STREAMS GROUP
MERCED COUNTY, CALIFORNIA

FINAL
OPERATIONS AND MAINTENANCE MANUAL

US ARMY CORPS
OF ENGINEERS
Sacramento District

January 2000

OPERATION AND MAINTENANCE MANUAL
MERCED COUNTY STREAMS GROUP
CASTLE DAM AND RESERVOIR, MERCED, CALIFORNIA

LOCATION	ADDITION OR REVISION	DATE
Exhibit B	Add copy of letter of transfer dated 27 Jan 2000	25 Mar 2010

MERCED COUNTY STREAMS GROUP
CASTLE DAM AND RESERVOIR, MERCED, CALIFORNIA
OPERATIONS AND MAINTENANCE MANUAL

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B-1 Local cooperation agreement between the Department of the Army and the State of California Reclamation Board for Flood Control Development for Construction of the Castle Dam and Reservoir, California, Project (15 sheets)

B-2 Agreement between State of California, The Reclamation Board and County of Merced. (12 sheets)

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F Monitoring Plan for Environmental Commitments (62 sheets)

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MERCED COUNTY STREAMS, CA
CASTLE DAM AND RESERVOIR

Pertinent Data

Castle Reservoir

DAM

Type	Zoned Earthfill
Top of dam elevation	218.5 feet
Freeboard above spillway flood pool	3.0 feet
Maximum height (bottom of core trench to crest)	51.0 feet
Side slopes	
Upstream	1V on 3.25H
Downstream	1V on 2.5H
Crest width	20 feet
Crest Length	2,075 feet

DIKES

Type	Homogeneous Earthfill
Crest width	10 feet
Crest length	1,150 feet

SPILLWAY

Type	Concrete, low ogee perched spillway
Spillway crest elevation	211.5 feet
Spillway crest width	180.0 feet
Maximum spillway discharge	4,800 cfs
Spillway design flood pool	215.5 feet

OUTLET WORKS

Type	Ungated riser intake with irrigation flow intake, cut and Cover conduit, conventional stilling basin
Riser -	
Height	32.5 feet
Crest elevation	210.0 feet
Crest length	16.25 feet
Width	7.25 feet
2.33'W x 2.33'H port at invert elevation	186.0 feet
3.1'W x 3.1'H port at invert elevation	195.0 feet

7.25'W x 9.5'H, irrigation intake (and bulkhead) at invert elevation	183.0 feet
Conduit –	
Diameter	7.25 feet
Invert Elevation	183.0 feet
Slope	0.01
Stilling Basin –	
Apron Elevation	171.6 feet
Width	14.0 feet
Length	48.0 feet

FLOWS

50-year maximum inflow	2,700 cfs
50-year maximum outflow	290 cfs
SPF maximum inflow	4,100 cfs
SPF maximum outflow	420 cfs
SDF maximum inflow (SDF=PMF)	9,050 cfs
SDF maximum outflow (SDF=PMF)	6,300 cfs

STORAGE

50-year flood pool elevation	206.5 feet	4,000 AF
SPF flood pool elevation	210.8 feet	6,400 AF
Spillway crest	211.5 feet	7,500 AF
SDF flood pool elevation	215.5 feet	11,000 AF

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ABRREVIATIONS

CCL – Canal Creek Location
cfs – cubic feet per second
CTLP – Castle Pool Data Collection Location
DCP – Data Collection Platforms
District Engineer – District Engineer of the Sacramento District, U.S. Army Corp's of Engineers
DM – Design Memorandum
EIS – Environmental Impact Statement
Flood season – 15 October through 15 April
GDM – General Design Memorandum
Irrigation Season – 1 March to 31 October
LERRD's – Lands, easements, rights-of-way, relocations and disposals
MID – Merced Irrigation District
SDF – Spillway Design Flood
SPF – Standard Project Flood
Superintendent – person appointed by local interests to be directly in charge
1V – one vertical foot
1H – one horizontal foot

MERCED COUNTY STREAMS GROUP
CASTLE DAM AND RESERVOIR, MERCED, CALIFORNIA
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 1 - INTRODUCTION

1.1 INTRODUCTION

The Merced County Streams, California, project is being planned, designed, and constructed by the U.S. Army Corps of Engineers in partnership with the State of California Reclamation Board. As construction for each feature is completed, operation and maintenance of that feature will be turned over to the State of California Reclamation Board.

This Maintenance Manual is only for the Castle Dam Unit of the project, which includes Castle Dam and Reservoir and appurtenances. The appurtenances include the check structure within Main Canal, the Canal Creek, Edendale Creek and Fahrens Creek Turnout Structures.

1.2 AUTHORITY

The Merced County Streams, California, project was authorized by Section 201 of the Flood Control Act of 31 December 1970 (Public Law 91-611, Section 201, 84 Stat. 1824). This Maintenance Manual is prepared in accordance with the instructions contained in ER 1110-2-401, dated 30 September 1994.

1.3 PURPOSE

The purpose of this Manual is to provide information, instructions, and guidance to the operating and other project personnel for the proper operation, inspection, and maintenance of the Merced County Streams, California, project facilities. The general intent is to insure that the structures and facilities required to regulate the reservoir shall be continually maintained in such a manner as to provide maximum safety and operational capability. Instructions pertaining to the physical operation of the facilities are also included. Since operation of the Castle Dam Unit is so simple, it will be included in this Maintenance Manual and no separate Water Control Manual is required to be prepared.

1.4 ORGANIZATION OF MANUAL

This Maintenance Manual is for the Castle Dam Unit of the Merced County Streams project which includes Castle Dam and appurtenances, the check structure on the Main Canal, the Edendale Creek and Canal Creek Turnout Structures along the west

levee of Main Canal with the appropriate creeks and rehabilitation of the Fahrens Creek Gates, (12 -18" high sluice gates).

1.5 PROJECT AREA

The Merced County Streams project is located in the eastern portion of the San Joaquin Valley, between the Merced and Chowchilla Rivers, in Merced and Mariposa Counties, California. Most of the project lies east and north of the City of Merced, with downstream channels passing through and around Merced, into the East Side Bypass, a state feature of the San Joaquin River Levee Project.

1.6 PROJECT DESCRIPTION

Castle Dam controls flows from Canal and Edendale Creeks (as shown on Plate I), and from the Main Canal north of Edendale Creek, and releases water back to Canal Creek in amounts that are within the downstream channel capacities. For Castle Dam to achieve maximum benefits, a check structure was constructed in the Main Canal just downstream from Edendale Creek. This check structure allows the natural runoff from the Canal and Edendale Creek basins to be maintained in their drainage basins without being diverted down the Main Canal.

1.7 CONSTRUCTION HISTORY

Construction of the Castle Dam Unit was accomplished under two major contracts, copies of which are on file in the office of the District Engineer, Sacramento District, Sacramento, California. Pertinent data on the contracts follows.

1.7.1 Castle Dam Contract.

Contract No.	DACW05-91-C-0055
Contractor	Ford Construction Company, Inc.
Work Started	March 14, 1991
Work Completed	February 1992
Transfer Letter	September 1994

1.7.2 Main Canal Check Structure and Fahrens Creek Gates Rehabilitation.

Contract No.	DACW05-93-C-0032
Contractor	B & L Builders, Inc
Work Started	April 5, 1993
Work Completed	April 14, 1994
Transfer Letter	September 1994

1.7.3 Trashrack Modification.

Contract No.	DACW05-95-R-0012

Contractor	Buddy's Contracting Service
Work Started	February 6, 1993
Work Completed	March 8, 1994
Transfer Letter	April 1995

1.7.4 Modification to the Edendale Creek Turnout Structure.

Contract No.	DACW05-98-C-0006
Contractor	Buddy's Contracting Service
Work Started	November 17, 1997
Work Completed	March 24, 1998
Transfer Letter	January 27, 2000

1.7.5 Modification to Existing Highway 59 Bridge Crossing with Edendale Creek

Contract No.	DACW05-98-P-0168
Contractor	Richard R. Simons Company, Inc.
Work Started	January 18, 1999
Work Completed	March 13, 1999
Transfer Letter	January 27, 2000

1.7.6 Restoration of Edendale Creek upstream of Highway 59 Bridge Crossing at Old Railroad Crossing

Contract No.	DACW05-99-P-0217
Contractor	Richard R. Simons Company, Inc.
Work Started	January 18, 1999
Work Completed	March 13, 1999
Transfer Letter	January 27, 2000

The contract at the existing Highway 59 bridge crossing and Edendale Creek was let in January 1998, but due to excessive floodwaters from Main Canal, construction work was held up until January of the following year. The restoration work upstream of Highway 59 was completed during the same duration period, January 18 through March 13, 1999.

1.7.7 Additional Construction Work to Complete Castle Unit

The Merced County Public Works Department is in the process of developing a set of plans and specifications to replace an existing concrete box culvert under the Oakdale Road, west of Highway 59. The local sponsor is handling this work because it is considered a relocation under the Local Cooperation Agreement, LCA.

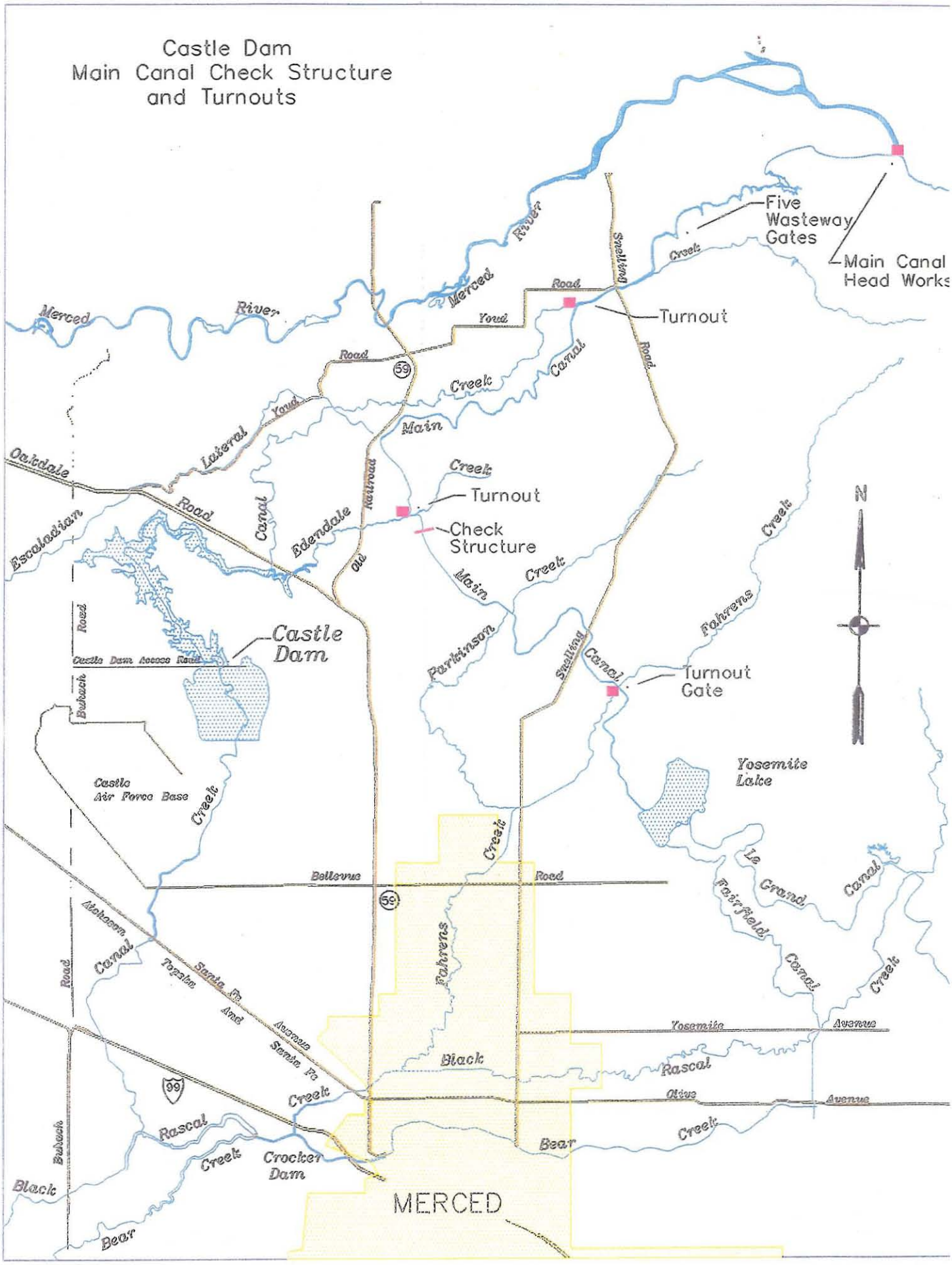
Castle Dam
Main Canal Check Structure
and Turnouts
Five
Wasteway
Gates
Main Canal
Head Works
Turnout
Turnout
Check
Structure
Turnout
Gate
Castle
Dam
Castle Dam Access Road
Castle
Air Force Base
Yosemite
Lake
MERCED
N
Merced River
Merced River
Yosemite Road
Road
Creek
Canal
Main Creek
Lateral
Oakdale Road
Escalodian Road
Edendale
Old Railroad
Parkinson Creek
Main Creek
Fahrens Creek
Stelling Road
Stelling Canal
Creek
Bellevue Road
Mahoney Road
Canal
Poplar Avenue
Santa Fe
And Santa Fe
Fairfield Canal
Le Grand Canal
Creek
Yosemite Avenue
Black Creek
Rascal Creek
Olive Avenue
Bear Creek
Crocker Dam
Bear
Black
Rascal
Buhach Road
Buhach Road
59
99

FIGURE 1

CHAPTER 2 - LOCAL COOPERATION REQUIREMENTS

2.1 APPLICABLE PORTIONS OF FLOOD CONTROL LEGISLATION

Public Law 91-611 authorizing the Merced County Streams, California project reads as follows:

> "The project for Merced County Streams, California, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in his report dated November 26, 1970, . . . Construction shall not be initiated until approved by the Secretary of the Army and the President."

The Water Resources Development Act of 1986 set forth cost-sharing requirements for the local sponsor and required that the local sponsor perform all operation, maintenance, replacement, relocations, and rehabilitation of flood control projects.

As a result of this legislation, a Local Cooperation Agreement (LCA) was signed by the U.S. Army Corps of Engineers and the State of California Reclamation Board for the Castle Dam Unit of the Merced County Streams, California, project (Castle Dam and Reservoir, the Main Canal Check Structure, and Fahrens Creek Gates Rehabilitation). This LCA was signed on 30 November 1988. Another agreement was signed between the Board of Reclamation and the County of Merced Public Works Department for cost sharing of the initial project (Castle Dam).

2.2 ASSURANCES PROVIDED BY LOCAL INTERESTS

The LCA spells out the obligations of the local sponsor concerning operation and maintenance of the project as follows:

> "Article II - Obligations of the Parties"
>
> "c. Following the period of construction, the Department of the Army (hereinafter referred to as the Government) shall turn the completed Project over to the Local Sponsor, which shall be solely responsible for operating, maintaining, inspecting, replacing, and rehabilitating the Project in accordance with Article VIII - OPERATION, MAINTENANCE, INSPECTION, REPLACEMENT, and REHABILITATION, hereof."
>
> g. No less than once each year following completion of the Project, the Local Sponsor shall inform affected interests of the degree of the protection afforded by the Project.
>
> h. Following completion of the Project, the Local Sponsor shall publicize floodplain information in the area concerned and shall provide this

information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development to ensure compatibility with protection levels provided by the Project.

i. Following completion of the Project, the Local Sponsor shall, to the extent of its powers, prescribe and enforce regulations to prevent any obstruction of or encroachment on the Project that would reduce the designed level of flood protection provided or that would hinder operation, maintenance, inspection, replacement, or rehabilitation of the Project. In addition, the Local Sponsor shall preserve or restore and thereafter maintain channels and diversion-of-flow structures required for conveyance of floodwaters within the project area to at least those capacities specified for the flood control system operation plan defined in the Water Control Manual. The capacity of the Canal Creek reach between Castle Reservoir and Black Rascal Creek shall be maintained to a capacity of 400 cfs. The Government shall provide the Water Control Manual to the Local Sponsor upon completion of the Project."

(Note: As explained in Chapter 1, no Water Control Manual will be prepared for the Castle Dam Unit. All required information will be provided in this manual.)

"Article VIII - Operation, Maintenance, Inspection, Replacement, and Rehabilitation

a. Upon completion of the Project, the Local Sponsor shall operate, maintain, inspect, replace, and rehabilitate the Project in accordance with the written regulations or directions prescribed by the Government.

b. The Local Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls, for access to the Project and for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, maintaining, replacing or rehabilitating the Project. If an inspection shows that the Local Sponsor for any reason is failing to fulfill its obligations under this agreement without receiving prior written approval from the Government, the Government will send a written notice to the Local Sponsor. If the Local Sponsor persists in such failure for 30 calendar days after receipt of the notice or fails to provide adequate assurances for fulfilling its obligations herein, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the Local Sponsor owns or controls,

for access to the Project for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the Project. No inspection, completion, operation, repair, maintenance, replacement, or rehabilitation by the Government in such event shall operate to relieve the Local Sponsor of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement."

CHAPTER 3 - GENERAL

3.1 REFERENCE TO APPROVED REGULATIONS

This Maintenance Manual, for the Castle Unit of the Merced County Streams project, California is furnished in accordance with provisions of Title 33 - Navigation and Navigable Waters, Chapter II, Corps of Engineers, Department of the Army, Part 208 - Flood Control Regulations, Maintenance and Operation of Flood Control Works, approved by the Secretary of War, 9 August 1944, and published in the Federal Register, 17 August 1944. A copy of this document is included in this Manual as Exhibit A. Operation plans for the Castle Dam Unit of the project are also included.

3.2 DEFINITIONS

As used herein, the term "Superintendent" means the person appointed by local interests to be directly in charge of an organization that will be fully responsible for the continuous inspection and maintenance of the project works. The term "District Engineer" means the District Engineer of the Sacramento District, Corps of Engineers, U.S. Army, or their authorized representative. "Flood Season" is considered to be the period between 15 October and 15 April. All elevations indicated herein are based on the National Geodetic Vertical datum (NGVD) of 1929 (formerly known as Mean Sea Level 1929).

3.3 GENERAL PROVISIONS OF REGULATIONS

In addition to the provisions quoted above, the general provisions of the Flood Control Regulations contained in paragraphs 208.10(a) (2) to 208.10(a) (9), both inclusive, are quoted as follows:

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with the regulations prescribed by the Secretary of the 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.

(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 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 an annual report to the District Engineer covering inspection, operation and maintenance of the protective works.

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

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

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

3.4 ASSISTANCE TO BE FURNISHED BY THE DISTRICT ENGINEER

The District Engineer will:

(1) Furnish the Superintendent "as-built" drawings of the flood control facilities at the time they are transferred or as soon thereafter as possible.

(2) Conduct the initial baseline inspection with the Superintendent and prepare the initial baseline report to serve as a tool to demonstrate what is required in the annual inspections and to document baseline conditions of the facilities.

(3) Review inspection reports of the flood control facilities and notify the Superintendent of any repairs or maintenance measures that the District Engineer

deems necessary in addition to the measures taken by the Superintendent.

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

(5) Assist the Superintendent, as may be practicable, in his duties of ascertaining storm developments having flood producing potentialities, assembling flood-fighting forces and materials, and initiating and carrying out flood-fighting operations. In this connection, it is suggested that the Superintendent obtain information about storm developments and their predicted magnitude by telephonic liaison with the San Joaquin Valley -National Weather Service, 900 Foggy Bottom Road, Hanford, California 93230.

3.5 RESPONSIBILITIES OF THE SUPERINTENDENT

In line with the provisions covered by the regulations, the general duties of the Superintendent, or his representative, shall include the following:

3.5.1 Training of Key Personnel

Key personnel shall be trained so that regular maintenance work may be performed efficiently and to ensure that expected problems related to flood control may be handled in an expeditious and orderly manner. They shall become familiar with:

- Federal Flood Control Regulations,
- This manual for operation and maintenance of the project,
- Water Level Recorder Bulletins,
- Project construction specifications,
- Project "as-built" drawings,
- Real estate rights and limitations,
- Safety requirements, and
- Mitigation and environmental laws and commitments.

The Superintendent, or his representative, shall have available the names, addresses, and telephone numbers of all his key personnel and a reasonable number of substitutes. These key personnel shall, in turn, have similar data on all of

the personnel who will be necessary for assistance in the discharge of their duties. The organization of key personnel shall include the following:

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

(2) People in sufficient number to lead maintenance patrol work of the entire project during flood fights. High qualities of leadership and responsibility are necessary for these positions.

The Superintendent or his representative, shall annually inform the District Engineer, on 1 October, of the names of personnel and their substitutes who will be responsible for operation of the project facilities during the flood season, 15 October to 15 April.

3.5.2. Files and Records

The Superintendent, or his representative, shall maintain a file of all reports, records, and drawings concerning the flood control facilities. A complete log of operation data is to be maintained, recording the time and amount of all changes to the stoplogs at the Main Canal Check Structure, the Edendale and Canal Creek turnout gates, and all information at Castle Reservoir including reservoir stages, estimated releases, spills over the spillway, and all operating decisions. The files and records are to be available to the District Engineer at all times. All information must be recorded for the flood season and for activities related to the flood control operation.

3.5.3. Encroachment or Trespass on Right-of-Way

In accordance with the provisions of Flood Control Regulations 208.10(a)(4), no encroachment or trespass that will adversely affect the efficient operation or maintenance of the flood control facilities shall be permitted on the lands or rights-of-way of the protection facilities. The Superintendent shall, therefore, cause notices to be posted at conspicuous places along the project right-of-way directing public attention to this regulation. The Superintendent shall arrange for the prosecution of offenders under local ordinances and shall report actions taken to the District Engineer.

3.5.4. Permits for Right-of-Way or Use of Portion of Right-of-Way

Requests for permits for temporary right-of-way or use of portions of the right-of-way shall not be issued without prior determination by the District Engineer that such use will not adversely affect the safety and functioning of the project structures or maintenance and flood-fighting operations. Regulations governing issuance of permits for use of rights-of-way for flood protection projects are contained in Exhibit A. Applications for such permits shall be submitted by the Superintendent to the

District Engineer sufficiently in advance of issuance to permit adequate study and consideration and determination of conditions to be embodied in the permit document. The California State Department of Water Resource's permit process meets these criteria. An executed copy of the permit document, as issued, shall be furnished the District Engineer.

3.5.5. Permits for Improvements or Construction Within the Project Right-of-Way

All requests for permits for construction of any improvement of any nature within the limits of the project right-of-way shall be referred to the District Engineer for determination that such construction will not adversely affect the stability, safety, and functioning of the protective facilities, or associated mitigation areas and for definition of conditions under which permit should be granted. (A sample permit form is attached in Exhibit A. The California State Department of Water Resource's permit process meets this criteria.) These conditions will include among others the following items:

(1) That all work shall be in accordance with the following:

(a) Standard engineering practice and in accordance with plans and specifications approved by the District Engineer or his authorized representatives.

(b) Drawings or prints of proposed improvements or alterations to the existing flood control works approved by the District Engineer.

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

3.5.6 Coordination of Local Activities

During the flood season, the Superintendent, or his representative shall communicate with all Federal, State, and local agencies to ensure the development of a coordinated flood-fighting program for Castle Dam, the check structure, and the turnout facilities. An outline of the established program shall be filed with the District Engineer and updated with the periodic inspection reports.

3.5.7 Inspection and Maintenance

(1) The Superintendent, or his representative, shall provide at all times such maintenance as may be required to ensure serviceability of the structures in time of flood. Periodic inspections shall be made by the Superintendent or his representative, to ensure that the above maintenance measures are being effectively carried out. The periodic inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period or

earthquake, and otherwise at intervals not exceeding 12 months, as further explained in Chapter 5. Immediate steps shall 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) The checklists shown in Exhibit D should be used in each inspection to ensure that no features of the protective system are overlooked. Items requiring maintenance should be noted thereon; if items are satisfactory, they should be indicated by a check. A photocopy of the inspector's original field notes, as recorded on the checklist, shall be transmitted to the District Engineer immediately following each inspection and one copy included as an enclosure to the annual report as provided in paragraph 3.5.8 of this manual.

(3) All repairs shall be made in accordance with standard engineering practice, to line and grade and in accordance with details shown on "as-built" drawings for the flood control facilities, copies of which are included after Plate 70.

(4) Full responsibility for repairs and methods used is placed on the Superintendent, but the experience and facilities of the Corps of Engineers will be available for advice and consultation.

3.5.8 Reports and Records

Annual Report: The Superintendent, or his representative, shall, within a 30-day period following the periodic inspection each year, submit an annual report to the District Engineer covering inspection and maintenance of the flood control facilities. A copy of these reports will also be provided to the General Manager of the Reclamation Board, State of California. This report shall present a statement of:

(1) The physical condition of the flood control facilities as summarized from the logs of inspection.

(2) Flood behavior of the flood control facilities and flood-fighting activities during the flood season.

(3) Prosecutions for encroachment or trespass.

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

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

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

(7) Fiscal statement of cost of maintenance for the period. A suggested form for submission of the annual report is included as Exhibit C.

(8) Status of Environmental commitments, which include:

(a) The number of times the vernal pools within the Castle Reservoir were inundated (if any) and the status of the monitoring contract for vernal pools, and

(b) A copy of the annual monitoring report for the wildlife mitigation area.

CHAPTER 4 - FEATURES OF CASTLE DAM AND APPURTENANCES UNIT

4.1 CASTLE DAM AND RESERVOIR

4.1.1 General

Castle Dam will impound flows from Canal and Edendale Creeks, and from the Main Canal north of Edendale Creek, and release water back to Canal Creek in amounts that are within the downstream channel capacities. The as-built drawings for Castle Dam are included as Plates 1 through 58. The as-built drawings for the Main Canal check structure downstream of Edendale Creek turnout are included as Plates 59 through 66. The trashrack modification to the Castle Dam intake structure as-built drawings are included as Plates 67 through 70. Pertinent data on the dam is summarized in front of Chapter 1.

4.1.2 Embankment Design

The dam embankment section is a homogeneous earthfill structure with a crown width of 20 feet. The maximum height above the original ground surface is 38.5 feet, and the crest is cambered 6 inches at the maximum section. The dam crest elevation is 218.5 feet. The downstream slope is 1V on 2.5H, while the upstream slope is 1V on 3.25H. A 3-foot thick horizontal drain blanket is included in the downstream portion of the embankment to control possible embankment and foundation seepage. The horizontal drain is protected above and below with a 9-inch layer of transition fill. Both upstream and downstream shells consist of random fill excavated from the spillway and upstream borrow. The upstream slope is protected with 12 inches of cobble placed on a 9-inch filter layer up to elevation 195 feet. The downstream slope and the remainder of the upstream slope were seeded with grasses and forbes to control dust and erosion. Stripping within the limits of the dam is a minimum of 12 inches deep. The foundation of the upstream portion of the dam was excavated to firm material. Explorations indicate the depth of firm clay averages 7 feet and does not exceed 10 feet. An impervious blanket was placed upstream of both abutments. The blanket is 5 feet thick at the toe of the dam and tapering to 3 feet at the upstream end.

4.1.3 Relief Well System

To reduce reservoir induced buildup of uplift pressure under the downstream toe of the dam, 12 relief wells were installed. The well locations are shown on the as-built drawings (Plate 5). Five observation wells will be used to monitor ground water levels near the relief wells.

4.1.4 Spillway

Castle Dam has a 180-foot wide concrete low ogee, perched spillway located approximately 1,400 feet north of the dam. The spillway structure consists of wingwalls, an ogee crest, and a short stilling basin, with derrick stone placed just downstream of the structure to resist scour. The approach and discharge channels have trapezoidal sections, with bottom widths of 180 feet and 186 feet, side slopes of 1V on 2H, and bottom slopes of 0.002 and 0.0015, respectively. Flow through the spillway exits into a drainage approximately 1,600 feet northeast of the dam, and is diverted into Canal Creek approximately 2,000 feet from the dam. The spillway crest elevation is 211.5 feet.

4.1.5 Outlet Works

The outlet works at Castle Dam consist of an ungated two-way drop riser with a crest elevation of 210 feet, and two square intake ports. One has a bottom edge elevation of 195 feet, sized 3.1 feet square, and the other is located in the bulkhead plate with a bottom elevation of 186 feet, sized 2.33 feet square. A 7.25-foot wide by 9.5 foot high bulkhead is used to pass non-flood season irrigation flows (bulkhead raised), while allowing for flood control releases (bulkhead lowered) through the 2.33 foot square port. Invert elevation for the riser is 183.0 feet. Entrance channel walls will be provided to restrain the dam embankment from interfering with the discharge ports.

The bulkhead is a fabricated steel slide gate with the above described intake port located at the center. A crank operated, geared floor stand (mounted on top of the concrete flange protruding from the top wall of the riser) is provided to seasonally raise and lower the gate. The hoist has a 20:1 gear ratio with a 3-inch diameter stem to provide the required lifting force of approximately 38,000 pounds. Access to the hoist is provided by a steel grated platform supported by a riser divider wall and a steel rung ladder mounted on the back wall of the riser.

The conduit diameter is 7.25 feet. The exit structure was designed as a stilling basin, with a parabolic drop of 34.3 feet in length, and a wall flare ratio of 10.67 to 1, ending with a 14 foot wide stilling basin that is 48 feet long. Two sets of baffle blocks and an end sill are included in the basin design. The exit channel is on an adverse slope of 1 to 10 for 50 feet immediately downstream of the 10-foot long exit trough, and then proceeds on a slope of 0.0025 until reaching Canal Creek. The exit channel has a 27-inch layer of riprap for the first 30 feet downstream of the basin endsill, an 18-inch layer for the next 30 feet, and a 12-inch layer to transition from the 18-inch layer to the remaining non-riprapped reach of the exit channel.

4.1.6 Dikes A and B

Dikes A and B consist of random fill placed on a foundation stripped 12 inches. The

upstream faces of the dikes have a 1V on 3H slope and the downstream faces have a 1V on 2.5H slope. All faces were seeded with grasses and forbes to control dust and erosion. The dike crest is 20 feet wide and has a crest elevation of 218.5 feet.

4.1.7 Instrumentation

Five observation wells were constructed similar to relief wells except for the boring depth, diameter and riser diameter as shown on Plate 5. The riser consists of 1-1/2 inch diameter slotted PVC pipe. The observation wells are located approximately 100 feet apart.

Eight survey monuments were installed to monitor crest settlement and movement. These monuments are located as shown on Plate 6. Periodic survey data will provide upstream, downstream, and cross-valley movement and settlement data.

4.1.8 Access Road

The access road to the dam follows a straight line along the edge of the property line from the intersection of Buhach and Eucalyptus Roads to the dam as shown on Plates 21-28. The road consists of two 10-foot lanes with 2-foot shoulders constructed within a 40-foot right-of-way. The surface consists of a 9-inch stabilized aggregate course.

4.1.9 Mitigation Area

Eighteen acres of land within the reservoir pool have been excavated and graded to create two swales. This area has been constructed such that intermittent water will pond and naturally reestablish riparian mitigation.

An additional 56 acres have been acquired for mitigation lands for a total of 80 acres. These 80 acres have been fenced to preclude grazing by livestock and any other unauthorized uses. Six acres were used for the construction of the Castle Dam embankment and the area downstream of the dam. Brush piles were created on the mitigation lands to provide cover for wildlife.

The dam embankment, spillway slopes and dikes A (outside the fee mitigation area) and B and other areas have been seeded with grasses and forbes to control dust and erosion. Blando brome (Bromis mollis), rose clover (Trifolium hirtum), California poppy (Eschscholzia californica), and Lana Vetch (Vicia dasycarpa) have been planted in well drained areas and Reed canary grass (Phalaris arundinacea) has been planted in poorly drained areas.

4.1.10 Flood Easements

Flood easements have been purchased for the entire reservoir area up to at least

elevation 215 feet, which is the top of the spillway design flood pool. These easements prohibit habitable structures from being constructed within the boundaries of the easements. The Superintendent should have copies of all the easements on file to refer to. Reference Chapter 7 for further description of flood easements.

4.2 MAIN CANAL CHECK STRUCTURE

4.2.1 General

The Main Canal, a feature of Merced Irrigation District's (MID) irrigation facilities, crosses Castle Dam's drainage basin approximately 13 miles upstream from the dam site. The Main Canal intercepts the flood flows coming down Canal and Edendale Creeks and carries them downstream. A check structure was constructed on Main Canal just downstream of Edendale Creek to insure Canal and Edendale Creeks' flows are diverted to Castle Dam.

4.2.2 Check Structure Design

The check structure consists of a conventional stoplog structure. The stoplogs are 3" by 12" treated lumber placed in stoplog guides at 4'-6" on center. A walkway is constructed on a horizontal truss that supports both the walkway and stoplog loads, transferring the loads to the abutments. A hand wheel operator is located on one of the center bays. It will allow adjustments to the stoplogs in that bay to meet the minimal stock water flow requirements during the flood season. Plates 59-65 show the contract drawings of the check structure. Merced Irrigation District revised the Check Structure by replacing the lower half of the stoplogs with a single gate. The upper half of the stoplogs still remains inplace but placed on top of the new gate(s). Telemetry was also installed on three gates at the Check Structure.

4.2.3 Fahrens Creek Turnout Modification

Merced Irrigation District's turnout from the Main Canal at Fahrens Creek consists of twelve bays, each with an 18" opening. Prior to the check structure construction contract, the turnout structure had only two bays with gate operators. Gate operators were installed on the other ten gates under the check structure contract. This was the extent of the modification. Plate 66 is the as-built drawing showing the modifications made.

4.2.4 Canal and Edendale Creeks Turnouts

Merced Irrigation District (MID) has turnouts along Main Canal at both Canal and Edendale Creeks. Canal Creek turnout along the Main Canal has nine bays. The outermost two have been filled with concrete by the MID. Of the remaining seven bays, the middle three are fitted with sluice gates to control the majority of the flows.

Stop logs of treated lumber, 3" by 12" have been placed in the final four bays. These bays will only be opened during flood conditions.

The original Edendale Creek turnout structure had four bays. Three new bays (the same size as the original) were added on to the original structure for a total of seven bay openings. Merced Irrigation District has replaced the old sluice gates with 4 foot by 4-foot solid sluice gates. In addition, all seven gates are controlled by new actuators (at each gate). Merced Irrigation District added telemetry equipment to all gates on the old four bay structure, so they could be control the gates from a remote site.

4.2.5 Flowage Easements

Flowage easements have been obtained along Canal Creek at 1,200 cfs and Edendale Creek at 2,500 cfs between the Main Canal and Castle Reservoir. These easements prohibit habitable structures from being constructed within the easement areas. California State Department of Water Resource's permits are required to work in the easements to regulate encroachments.

Water gaps were constructed on Edendale Creek just downstream of Oakdale Road and another just downstream of Highway 59. These water gaps were constructed to ensure cattle remain in the grazing pastures. Water gaps were installed at the junction of the creeks and at the property fencing. Water gaps prevent cattle from crossing under the existing fencing during low flows, and swing on a cable during high flows. These water gaps were constructed under a separate purchase order contract with approval by a Corps of Engineers representative. The landowner was completely satisfied with the water gaps.

CHAPTER 5 - INSPECTION AND MAINTENANCE OF THE PROJECT WORKS

5.1 GENERAL

This chapter provides guidance for inspection and maintenance of Merced County Streams Project, Phase I, which includes Castle Dam and Reservoir and the Main Canal Check Structure. Detailed descriptions of the project features are covered in Chapter 4.

5.2 DAMS, BASINS, DIKES, AND EMBANKMENTS

5.2.1 Annual inspections

Annual inspections shall be made by the Superintendent or his authorized representative to ensure that:

(1) No unusual settlement, sloughing, or material loss of grade or embankment cross-section has taken place;

(2) No caving has occurred on either the landside or the riverside of the embankment, which might affect the stability of the embankment section;

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

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

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

(6) No damage to embankments is resulting from burrowing animals;

(7) A strong root growth must be maintained on the embankment slopes. No burning of grass and weeds during inappropriate seasons, nor any action which shall retard or destroy the growth of grasses and forbes will be allowed.

(8) Access roads are being properly maintained;

(9) Any cattle guards and gates are in good condition;

(10) Crown of embankment is shaped to drain and roadway is well-shaped and maintained;

(11) There is no unauthorized grazing or vehicular traffic on the embankments;

(12) Encroachments are not being made on the embankment right-of-way, which might endanger the structure or hinder its proper and efficient functioning during times of emergency. Also, encroachments are not being made on the flowage easements along Canal and Edendale Creeks and on the flood easements behind Castle Reservoir.

(13) Gates at the Canal, Edendale, and Fahrens Creeks turnouts must be operable to fully opened and closed positions. The stoplogs at the Main Canal Check Structure must be maintained to allow proper placement and removal. The gate for passing irrigation flows at Castle Dam must be operable to fully opened and closed positions.

(14) The trashrack at the riser intake, the outlet conduit and stilling basins are in good condition and are free of debris.

5.2.2 Specific Requirements

To ensure proper maintenance measures for the embankment sections are being followed; the following items will be specifically covered in each inspection:

(1) Settlement, sloughing, or material loss of grade or embankment cross section;

(2) Erosion of embankment slopes;

(3) Presence of seepage, saturated areas, or sand boils downstream of the embankment;

(4) Condition of sod cover;

(5) Condition of access roads;

(6) Condition of toe drains and riprap.

5.2.3 Maintenance Methods

Maintenance methods to be used for repair or reconstruction of embankment fill will depend on the extent of the damaged section. The most suitable method for minimal damage will be to bring the embankment back to line and grade by a fill made in 6-inch layers of coarse granular material, such as sand and gravel or of similar adjacent material. Larger damage areas will require the fill to be constructed in the

same manner as the original construction with homogeneous material from borrow pits approved by the District.

5.2.4 Sod

A hardy sod, which covers the entire embankment and protective berm, is one of the most effective means of protecting areas against erosion and wave wash. Large weeds and brush will not be permitted to grow on the embankment. Mowing or other alternative methods to keep weeds and brush under control will be accomplished in May and August, or more often if necessary, to assure a good sod cover. Grass clippings will be left on the areas being mowed. If large weeds and brush become established because of lack of proper maintenance, they will be cut and removed from the dam or dikes for disposal, and cuttings will not be burned on the embankment. Infertile bare areas may be treated by mulching with manure containing straw or straw mulch plus seeding or sodding. If straw mulch is used, a suitable commercial fertilizer should also be used to hasten the establishment of a protective sod cover.

5.2.5 Burrowing Animals

Burrowing animals found in the embankments will be removed. The dens and runways will be opened up, then thoroughly compacted, as they are backfilled. Advice concerning the best methods in each locality can be obtained from the county agricultural agent. Care should be taken to assure the methods used are environmentally safe so that wildlife, other than those targeted, will not be harmed, and that no toxic substances get in the water. Castle Dam is within the range of the San Joaquin kit fox and blunt-nosed leopard lizard, which are protected by state and federal law. The California Department of Fish and Game and the U.S. Fish and Wildlife Service shall be consulted prior to any actions to remove individuals of these species or to open up their burrows.

5.2.6 Access Roads and Ramps

Access roads and ramps will be properly maintained so that ordinary maintenance work and flood-fighting operations will not be obstructed.

5.2.7 Toe Drain

It is important that the toe drain at the downstream toe of the dam be kept functioning properly. In the event the drain becomes clogged and seepage through the embankment section occurs, the District Engineer will be consulted for analysis and recommendation of remedial measures.

5.3 FLOOD EMERGENCY INSPECTION

5.3.1 General Requirements

During flood periods, embankments will be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

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

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

(3) Debris is not clogging the outlet works;

(4) Any low reaches of Main Canal that may be overtopped by the flood are identified and appropriate actions taken to notify people affected and to avoid canal embankment failure;

(5) No other conditions exist that might endanger the structure;

(6) Appropriate advance measures are being taken to ensure the availability of adequate labor and materials to meet all contingencies, immediate steps are being taken to control any condition that endangers any embankment, and to repair the damaged section.

5.3.2 Responsibilities of the Superintendent or Their Representative

It will be the duty of the Superintendent, or their representative, to maintain a continuous patrol of the flood control facilities during all major high water periods in which the water stage in the reservoir reaches elevation 200 feet (msl); and to maintain a store of supplies and equipment available for emergency flood-fighting operations and emergency repairs.

Vernal pools are located between elevations 200 and 210 (msl) within the reservoir. If any pools are inundated during the flood season, the Local Sponsor will be required to survey and assess damages to the vernal pools. Reference Exhibit "F" for a better description of sampling the vernal pools.

The Superintendent will dispatch a message by radio, telephone, telegraph, or other rapid means of communication to the District Engineer whenever the water surface reaches the flood stage indicated above. The Superintendent shall also keep the District Engineer advised at frequent intervals of project conditions until the reservoir stage recedes to back below the flood stage indicated above.

5.4 CHANNELS AND FLOODWAYS

Since the Main Canal is a functional part of the system that allows natural waters to continue downstream, it must be maintained to ensure its integrity. The Superintendent, or his representative, will be responsible for working out an agreement with Merced Irrigation District (owner and operator of the Main Canal) to ensure it is maintained, inspected, and operated properly.

In addition, the natural channels of Canal and Edendale Creeks will carry flood flows to Castle Reservoir from the Main Canal. Flowage easements have been obtained for these reaches of the creeks. These creeks need to be inspected to ensure that they are kept clear for floodflows and that no encroachment occurs. The water gaps just downstream of Oakdale Road and Highway 59 along Edendale Creek must be kept clear of all debris.

5.4.1 Periodic Inspections

Periodic inspections of the Main Canal, Edendale and Canal Creeks will be made by the Superintendent to be certain that:

(1) The Main Canal is clear of debris, weeds, and wild growth that may restrict its capacity;

(2) Canal and Edendale Creeks are kept clear of constrictions that may cause flood flows to leave the boundaries of the flowage easements.

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

(4) The capacity of Main Canal, Edendale Creek, and Canal Creek to pass natural flood waters into Castle Dam and Reservoir is not being reduced by the formation of shoals;

(5) Banks of the Main Canal are not being damaged by rain or wave wash and that no sloughing of banks has occurred;

(6) Any riprap sections, deflection dikes, and walls are in good condition;

(7) Approach and egress channels adjacent to the Main Canal are sufficiently clear of obstructions and debris to permit proper functioning of the flood control facilities;

(8) Immediate steps are taken to remedy any adverse conditions disclosed by such inspections;

(9) Any culverts along Canal, Edendale, and Fahrens Creeks are clear and free of debris.

5.4.2 Purpose of Flood-Flow Channel Inspection

The purpose of the flood-flow channel inspection is to ensure that conditions which affect the channel capacity will remain as far as reasonably possible, the same as those considered in the design assumptions; and that no new conditions develop that may affect the efficient functioning and stability of the project structures. At each inspection, particular attention will, therefore, be given the following:

(1) Location, extent, and size of vegetal growth;

(2) Unauthorized operations within the flowage easements along Canal and Edendale Creeks, or within the Main Canal right-of-way, such as excavations, buildings and other structures, levees, bank protection, or training dikes;

(3) Rubbish disposal;

(4) Changes in the channel bed, such as aggradations or degradations that would interfere with free flow through structures and road crossing culverts;

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

5.4.3 Vegetal Matter

To ensure that vegetal matter, if dislodged, will not seriously clog Castle Dam's outlet works, the road crossing culverts and bridges, or any other location, it will be cut and removed from the channel when inspection discloses it to be a hazard. Project mitigation requires that living and dead vegetation not be removed unless it presents a hazard to the dam, spillway, or outlet works. To the extent they do not present a safety hazard, large, dead standing trees are to be left as habitat for perching and nesting birds.

5.4.4 Eroded Concrete

Repair of eroded concrete should be initiated as soon as reinforcing steel is exposed or erosion approaches the clear cover depth over the reinforcing steel (i.e. 2 inches). Although pneumatically placed concrete is a common method of concrete repair; the actual method to be used for a particular repair will depend on the type and extent of

the eroded or spalled area. Suitable methods might include the use of some adhesive epoxy materials as well as cement mortar or grout.

5.4.5 Damaged Fencing

All damage to fencing, whether resulting from accidental or willful injuries or from corrosion, will be promptly repaired with new material on fee titled by the local sponsor.

5.5 OUTLET WORKS, TURNOUTS, CHECK STRUCTURE

5.5.1 General Requirements

Adequate measures will be taken to ensure that inlet and outlet channels are kept open and that trash drift or debris is not allowed to accumulate near drainage structures. The gate operators, shafts, and bearings on the turnouts at Fahrens Creek, Canal Creek, and Edendale Creek will be examined, oiled, and trial-operated twice a year; once before the flood season and once at the end of the flood season. Periodic inspections will be made by the Superintendent, or his representative, to be certain that:

(1) Pipes, gates, operating mechanisms, riprap, and headwalls are in good condition;

(2) Inlet and outlet channels are clear and free of debris;

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

(4) Erosion is not occurring adjacent to a structure that might endanger its water tightness or stability;

(5) Immediate steps are taken to repair damage, replace missing or broken parts, and to remedy adverse conditions disclosed by such inspection;

(6) Culverts and any lateral ditches are free of debris, and side slopes of ditches are free of debris, and side slopes of ditches are in good condition;

(7) Guard fences, posts, wires, and cables are in good condition. Broken or missing parts will be immediately repaired or replaced.

5.5.2 Specific Requirements

At each inspection required by paragraph 3.5.7 of this manual, the following items, if applicable, will be particularly noted for Castle Dam, the Main Canal Check Structure, and the turnouts at Edendale, Canal, and Fahrens Creeks:

(1) Damage or settlement of concrete pipe or conduits;

(2) Condition of gate and stoplog guides, stems, and hoists;

(3) Condition of operating mechanisms of the gates;

(4) Condition of any drainage gate covers and hinges;

(5) Condition of concrete cracks, spalls, and erosion;

(6) Debris or other obstructions to flow;

(7) Condition of access bridges;

(8) Condition of all other metal parts;

(9) Condition of embankments adjacent to outlet and drop structures;

(10) Condition of stoplogs;

(11) Condition of riprap stone blanket or protective cover adjacent to outlet or drop structures;

(12) Condition of paint on fence posts, gates, and any other painted surface;

(13) Condition of any cable clamps;

(14) Damage to any drop structures;

(15) Condition of all culverts affected by or affecting the project;

(16) Note any erosion of any lateral ditches and culvert outlets.

5.5.3 Concrete Repair

Repair of eroded concrete should be initiated as soon as reinforcing steel is exposed or erosion approaches the clear cover depth (i.e. 2 inches). Although pneumatically placed concrete is a common method of concrete repair, the actual method to be used for a particular repair will depend on the type and extent of the eroded or

spelled area. Suitable methods might include the use of some adhesive epoxy materials as well as cement mortar or grout. All evidence of settlement, uplift, or failure of concrete structures will be referred to the District Engineer for analysis and recommendation of remedial action.

5.5.4 Gate Inspections

If the inspection shows any of the gates have been jammed by debris or other obstructions, they will be thoroughly cleaned so they operate freely to a full opening or full closure.

5.5.5 Gate Maintenance

The operating mechanisms of the gates at Castle Dam, the Main Canal Check Structure, and Edendale, Canal, and Fahrens Creeks turnouts will be kept well lubricated. For all main requirements, refer to exhibit H, Gate Maintenance, sheet number 1 through 26.

5.5.5.1 Canal and Edendale Creek Gates

These are existing gates which are owned, operated and maintained by Merced Irrigation District. The Superintendent, or his representative, will work out an agreement with Merced Irrigation District to determine which agency will do the operation and maintenance of these facilities. The Superintendent will obtain from the irrigation district any special maintenance requirements for these gates.

5.5.6 Painted Surfaces

All painted surfaces of the gates and their accessories, any structural steel access bridges, and other miscellaneous metalwork in the outlet, turnout, or check structures will be repainted every three years or as required by the local irrigation district standards. Prior to repainting, all surfaces will be thoroughly cleaned, and the painting will conform to the requirements for Paints and Painting contained in Section 14 of the Sacramento District Office Specification No. 1241 for the construction contract.

5.6 PRE-FLOOD

5.6.1 Operation

Before flood flows are expected, all gates will be inspected to ensure that objects that might prevent proper operation of the gates are removed.

5.7 INSTRUMENTATION

5.7.1 Survey Monuments

The survey monuments consist of 3-foot lengths of 5/8-inch reinforcement bars surrounded by lean mix concrete approximately 8 inches in diameter and 2 foot 6 inches deep. A brass cap was placed on top of the concrete.

As part of the annual inspections, observations are to be taken and submitted to the District Engineer. In the event that unexpected movement is indicated by an observation, the District Engineer may require additional readings. Survey requirements include determination of elevation and horizontal movement.

In addition to scheduled surveys, surveys will be performed if embankment cracking, sloughing, or loss of grade is observed. Monuments in the vicinity of the distressed area shall be surveyed first.

5.7.2 Observation Wells

As described in Chapter 4, five observation wells were installed. The procedure to take a reading is as follows:

(1) Unlock and open lid covering the well.

(2) Remove PVC cap from pipe.

(3) Check water level indicator device to see if it is operating properly by inserting sensor probe in a jar of water.

(4) Dry off the probe and carefully lower the probe into the pipe. Based on the depth of the previous reading, stop the probe a few feet above the free water surface.

(5) Slowly lower the probe until contact with water is made. Record the depth to the nearest foot.

(6) It should be noted that condensation forms on the walls of the well. This will tend to collect on the probe and indicate water contact has been made. Shake the lead wire and probe to insure that the indicator needle does not fluctuate and drop, thus giving a false reading.

(7) After each reading, the probe should be dried. The PVC cap should be replaced on the pipe and the cover should be shut and locked.

(8) After all the readings are taken, clean and dry the probe and the instrument with a dry soft cloth prior to storage.

When the observation wells remain dry, readings should be taken on an annual basis. Readings will be taken on a quarterly basis for wet wells or when ground water is detected. Readings will be taken weekly once the reservoir level raises above elevation 200 feet (msl).

Results of the readings will be sent to the District Engineer.

5.7.3 Relief Wells

Twelve relief wells were installed along the downstream berm as described in Chapter 4. The procedure and reading frequency of the relief wells will be the same as for the piezometers. The function of the relief wells is to provide a reduction in the uplift forces near the toe of the dam. Proper maintenance of the relief wells is essential to the continuing safe operation of the project. Therefore, a plan for inspection, monitoring, evaluation and maintenance is essential.

The relief well water levels will be made at the same time the observation wells are read. Flow from the relief wells will be recorded and correlated with pool elevation. The amount of sediment in the wells will be recorded on a yearly basis. In addition, pumping tests will be performed at five (5) year intervals. An initial pumping test was not performed by the Government after construction of the dam because the ground water level was below the invert of the relief wells. An initial pump test will be performed by the dam owner once the ground water level has risen to a few feet above the tip of the relief wells. Typically, the water level in the relief wells will be from about one fourth to three-fourths the height of the well. The specific capacity and the well efficiency will be determined by pumping tests. If there is a reduction in the capacity of the relief wells accompanied by an increase in the observation well water levels or a decrease in the efficiency of the wells of 20 percent or more from the initial pumping test, the relief wells will be redeveloped by mechanical or chemical methods. Mechanical methods include water jetting, block surging, over pumping, or blowing out with compressed air. Chemical methods include the use of various acids, chelating agents, chlorine, hypochlorites, detergents, and hot water or steam. Results of the annual inspection of the relief wells' readings as well as results of pumping tests will be sent to the District Engineer.

5.7.4 Operational Instrumentation

To monitor and record hydrologic events at Castle Dam, two hydrologic Data Collection Platforms (DCP) have been installed, one is located in the gage house on Castle Dam (Castle Pool, CTLP) and the other is located in the outlet stream gage (Canal Creek, CCL). These two DCP sites measure and record Pool Elevation, Outlet Works Gate Height, and downstream Stage. Both the pool gage and the

outflow stream gage data recorders have been equipped with telephone and data/voice modems so that data can be retrieved in real-time from both gages in either voice or electronic format. Since there is no commercial power to these two locations, solar cells and 12V batteries are used to power the phone, instrumentation, and data recorder. The following tables list the major instrumentation at each location:

Castle Dam Pool Data Collection Platform Instrumentation		
Item	Bar Code	Location
SUTRON 8200 Data Recorder with internal modem	E2306	Pool Gage House
Motorola Cellular Phone	E2484	Pool Gage House
Pool Elevation Shaft Encoder (quadrature signal)	None	Pool Gage House
Gate Height Shaft Encoder (quadrature signal)	None	Gate Gear Box
ARCO M25 Solar Cell	J3088	Pool Gage House (roof)
ARCO M25 Solar Cell	J3227	Pool Gage House (roof)
Electric Tape	None	Pool Gage House

Canal Creek Data Collection Platform Instrumentation		
Item	Bar Code	Location
SUTRON 8200 Data Recorder with internal modem	E2271	Stream Gage House
Stage Elevation Shaft Encoder (quadrature signal)	None	Stream Gage House
ARCO M25 Solar Cell	J3089	Stream Gage House (roof)
Electric Tape	None	Stream Gage House

The following manuals are provided:

- SUTRON 8200 Data Recorder Operations Manual
- Shaft Encoder Users Manual

5.7.4.1 Daily Operation

The Data Recorder's Recording Status is to be left on at all times so that 15 minute data will be logged. The electric tape should be disconnected from the battery when not in use to avoid accidentally draining the battery.

5.7.4.2 Monthly Maintenance

Both the pool and the downstream gages are to be checked on a monthly basis. The floats are to be checked to confirm that they are hanging freely and vertical movement is free and unobstructed. Rodent and insect nests are to be removed from both gage houses and instruments. Electric tape elevations are to be checked with exterior staff gages and the Data Recorder reset to reflect the correct pool/stage elevation. When gate operations occur, the Data Recorder's readings are to be checked and corrected as required. Battery voltages are to be checked. Should battery voltage drop below 12 Volts, new batteries are to be installed. The cause of the low battery voltage should be determined and corrected.

5.7.4.3 Annual Maintenance

Float wells are to be back flushed annually to clear float well intakes of sediment. Note: the float must be removed during a back flush operation and then reinstalled and recalibrated with the electric tape and staff gages.

5.7.4.4 Multi-year Maintenance

Batteries are to be replaced at a minimum at three-year intervals to assure reliable operation. Note: the Data Recorder also contains a small internal lithium battery, which is to be replaced at this time.

5.7.4.5 Data Archiving

It is recommended that data be downloaded from the Data Recorder to a permanent database for archiving on a monthly basis. Exhibit I contains the midnight readings for CTLP and CCL as recorded since installation of the above instrumentation, and a tabulated format for future recording of the data.

5.8 MISCELLANEOUS STRUCTURES AND FACILITIES

5.8.1 General

Miscellaneous structures and facilities constructed as a part of the flood control facilities and other structures and facilities that function as a part thereof or affect the efficient functioning of the flood control facilities, will be periodically inspected by the

Superintendent, or his representative, and appropriate maintenance measures taken. Damaged or unserviceable parts will be repaired or replaced without delay.

5.8.2 Inspection Frequency

Inspection of the miscellaneous facilities will generally be made at the same time that the inspection of the other features of the project are made and will be reported on indicated check lists shown in exhibit D.

5.8.3 Purpose

The purpose of maintenance work is to ensure continuous, satisfactory operation of the facilities. It is therefore important that all possible causes of future trouble be found and corrected. Additional inspection and maintenance measures, more particularly applicable to each type of facility, are given in the following:

5.8.3.1 Gates and Fences

If, upon inspection, it is found that the steel gates or fence posts have been damaged or broken, they will immediately be repaired and maintained in good operation condition. If there are any holes in the gates of fences, these will be immediately repaired. If any gates are locked, the keys will be kept readily available by the Superintendent at the project site to permit ready passage through such gates of all authorized travel.

5.8.3.2 Miscellaneous Road Culverts and Bridges

If inspections show the presence of silt or debris that is restricting flow in culverts or through bridges along the dam access road or over Canal, Edendale, or Fahrens Creek, it will be removed. Any other adverse conditions found upon inspection will be promptly corrected.

5.8.4 Flooding Emergency

5.8.4.1 Operation

Miscellaneous facilities will be operated to prevent or reduce flooding during periods of high water. Those facilities constructed, as a part of the flood control facilities will not be used for purposes other than flood protection without approval of the District Engineer.

5.8.4.2 Inspection of Road Culverts and Bridges

During flood events, constant inspections should occur to determine if silt or debris is restricting flow in culverts or bridges along the dam access road or over Canal,

Edendale, or Fahrens Creeks. Actions will then be taken to have it removed. Any other adverse conditions found upon inspection will be promptly corrected.

CHAPTER 6 - SUGGESTED METHODS OF COMBATING FLOOD CONDITIONS

6.1 GENERAL

The methods described have been developed during experience with the various problems that often arise during periods of high water. The procedures are not intended to restrict the Superintendent or others concerned, or to establish a rigid set of rules for every condition that may arise. If problems arise where the Superintendent is in doubt as to the procedure to be taken, he should consult the District Engineer.

6.2 CAUTIONS CONCERNING EARTHFILL EMBANKMENTS

An earthfill embankment is in potential danger whenever there is water against it. This potential danger is directly proportional to the height of the water, the duration of the flood stage, and the intensity of either the current or wave action. A well-constructed embankment of proper section, if properly maintained and not overtopped, should hold throughout any major flood. Foundation troubles may result in sand boils or sink holes. Wave wash is to be expected whenever the embankment is exposed to a wide stretch of open water for extended periods.

6.3 SECURITY

The responsibility for protecting flood control works against sabotage, acts of depredation, or other unlawful acts rests with the local interests through local and State Government agencies.

6.4 PREPARATORY ACTIONS

The Superintendent will develop an organization capable of implementing the provisions discussed in Section 3.5 of this manual. Immediately prior to flood season the Superintendent should do the following:

(1) Ascertain that all roads to the embankments are in good state of repair;

(2) Locate necessary tools and materials (sacks, sandbags, brush, lumber, lights, etc.) and store these materials at strategic points;

(3) Check the location of all telephone lines and equipment necessary for emergency operation.

6.5 EMERGENCY EMBANKMENT REPAIRS

The methods of combating various defects in earthfill embankments described in the

following paragraphs have been proven effective. Castle Dam was designed to eliminate these problems. If, however, problem areas develop, they can be successfully combated by these methods. In case of an emergency problem, the District Engineer should be notified immediately.

6.5.1 Downstream Slopes

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

6.5.2 Sand Boils

The common method of controlling sand boils consists of building a watertight sack ring around the boil up to a height necessary to reduce the velocity of flow to a point at which material is no longer discharged from the boil (See exhibit E, sheet 1). The sack ring around the boil should be large enough to protect the defective area immediately surrounding the boil. If several boils of sufficient force to displace the sand are observed, a sack sub-levee may be built around the entire nest of boils, rising to such height that none of the boils will discharge with enough force to displace sand.

6.5.3 Wave Wash

The Superintendent and other assigned personnel should study the embankment beforehand to determine the possibility of wave wash. Sections of cotton bagging will be placed over the washed areas, as shown on sheet 3, exhibit E. As an alternative, filled sacks will be placed in the cut in an effective manner and as soon as possible. The filled sacks will 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. Sheet 2, exhibit E, 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.

6.5.4 Scour

A careful observation will be made of the waterside of the embankments at all localities where a current is observed. Trouble areas may be looked for at the ends of dikes, road-crossing ramps, old traverses, and places where structures penetrate the embankment. If any sign of scour is observed, soundings will be taken to observe the

amount and progress of the scour. Scour can be checked by constructing deflection dikes using brush, treetops, or lumber; driving stakes and wiring together; and filling in between with brush and filled sacks or stone.

6.5.5 Caving Bank Protection

Rock-filled cribs are very effective if properly placed. Cribs are usually 14 feet by 14 feet in plan by 10 to 14 inches in inside depth. The cribs are constructed on a double thickness of 1 inch by 4 inch by 14 foot lumber, equivalent to 2 inch by 4 inch 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 sidewalls. The floors and covers are built up of double 1 inch by 4 inch 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 sidewalls and one over the central division wall. All intersections are nailed with one twenty-penny 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 sheet 4, exhibit E).

6.5.6 Debris

Should debris buildup on the outlet works trashrack occur, the blockage may be freed by using a long steel pole to guide debris from the sloped sections of the inclined trashrack.

6.6 TOPPING ON THE MAIN CANAL

The operation of the Phase I facilities involves the Main Canal. If it is determined that the Main Canal may be overtopped during a flood event, emergency topping should be undertaken at once.

6.6.1 Sack Topping

Sack topping may be used to raise the crown on the embankment about three feet. The sacks should be laid stretcherwise or along the crown for the first layer, crosswise for the second layer, and so on. Sacks should be lapped at least 1/3 either way and well mauled into place. When properly sacked and tamped, one sack will give about 3 to 4 inches of topping. If gravel is available, it should be used for the front facing so as to avoid washing out.

6.6.2 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 toppings, a careful line of levels should be run and grade stakes set in advance. Two inch by 4 inch by 6-foot stakes should then be driven on the stream side of the crown 6 feet apart and 1-inch by 12-inch 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 3 feet into the ground, and should project out 3 feet, thus providing in extreme cases, a 3-foot topping if properly braced behind with sacks and earth. In some instances, it may be practical to back up the planking with tampered earth obtained in the vicinity in lieu of the sacks.

6.7 TRANSPORTATION

Plank paving and steel or wire mats should be considered when delivery of equipment is made over impassable, muddy, or excessively sandy roads. Two-way radio or telephone communication should be provided in these situations.

6.8 USE OF GOVERNMENT PROPERTY

The District Engineer is authorized to use or loan Federal Government property and assistance in cases of emergency where life is in danger and there is no opportunity to secure prior authority for such use. The authority also extends to saving of property where no suitable private equipment is available, provided that such use is without detriment to the Government.

CHAPTER 7 - REAL ESTATE REQUIREMENTS

7.1 REAL ESTATE REQUIREMENTS

The local sponsor is required to provide all lands, easements, rights-of way, relocations and disposals (LERRD's) necessary for the construction, operation and maintenance of the project. The local sponsor receives credit towards its share of project costs for the fair market value of the required LERRD's.

The minimum interests required are fee title to the dam site, outlet works, and fish and wildlife mitigation lands, permanent easements for levees. Channel improvements, flowage areas, access/maintenance road, ponding areas, pumping plants and appurtenances; temporary easements for excavated material or borrow areas necessary for construction.

The real estate requirements for Castle Dam and reservoir are as follows:

7.1.1 Types of Estates

The impact on the property caused by the Castle Dam and Reservoir is based on the acquired estates as described below:

(1) Fee: The estate gives a fee title to the property, subject to existing easements for public roads and highways, public utilities, railroad and pipelines.

(2) Flowage Easements (Occasional Flooding): This estate gives the perpetual right to occasionally overflow, flood, and submerge land as necessary to operate and maintain the project. It precludes the construction of structures for human habitation and all other structures except as approved by the District Engineer. Permanent flooding will occur below elevation 193.5.

(3) Flowage Easement (Permanent Flooding): This estate gives the perpetual right to permanently overflow, flood, and submerge land as necessary to operate and maintain the project. It precludes the construction of structures for human habitation and all other structures except as approved by the District Engineer.

(4) Road Easement: A perpetual and assignable easement and right-of-way in, on, over and across land for the location, construction, operation, maintenance, alteration and replacement of a road.

(5) Temporary Work Area Easement: A temporary easement and right-of-way in, on, over and across land for a specified period for use as a borrow area and work area, and to perform any other work necessary and incidental to the construction of the project.

(6) Flood Protection Levee Easement: A perpetual and assignable right and easement in land to construct, maintain, repair, operate, patrol, and replace a flood protection levee.

(7) Channel Improvement Easement: A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across land. Including the right to clear, cut, remove, and dispose of timber, trees, underbrush, buildings improvements, and /or other obstructions. In addition, the right to excavate, dredge, cut away and remove any or all of said land and to place thereon dredge or spoil material are also included.

7.2 ACTUAL REAL ESTATE ACQUIRED

The real estate mapping identifies owners, tracts, areas, and estates acquired for the Castle Dam Unit project, and are shown in Appendix A. A record of survey of the Castle Dam Area with a listing of the northerly and easterly coordinates and elevations is included in Appendix B. A copy of the acquired easements and agreements will be included in Appendix B after settlement with the property owners.

CHAPTER 8 - ENVIRONMENTAL COMMITMENTS

8.1 INTRODUCTION

As part of the construction and operation of Phase I facilities, mitigation and environmental commitments were incorporated into the project. The Superintendent and his representative must be aware of these commitments and be responsible for complying with them.

8.2 ENVIRONMENTAL COMMITMENTS

Following are the mitigation and environmental commitments, which are part of Phase I:

(1) Live vegetation along Canal Creek is to be left, except for those areas to be used for borrow areas and for the construction of the dam, spillway, outlet works, dikes, and haul roads. Dead, fallen trees, and other debris in the pool area that could present a safety hazard to the dam, spillway, or outlet works are to be removed at the time of construction and during routine maintenance. To the extent they do not present a safety hazard, large, dead, standing trees are to be left as habitat for perching and nesting birds.

(2) The loss of 13 acres of habitat due to construction of the facilities is mitigated by enhancing 18 acres of land within the reservoir pool between elevation 192.5 feet and 205 feet. An additional 22 acres have been acquired for mitigation lands for a total of 40 acres. This mitigation area has been fenced. The fence will be maintained throughout the year and is to be inspected annually at the end of the flood season.

(3) A portion of the 18 acres of land discussed above was used for borrow material. This area was excavated and graded to create two swales such that intermittent water that flows into the reservoir will naturally reestablish riparian mitigation.

(4) During construction topsoil was stockpiled and later applied to any disturbed lands within the mitigation area to a minimum depth of 1 foot to enhance the reestablishment of vegetation.

(5) Mitigation areas, dam embankment, spillway, and other areas disturbed during construction were reseeded with nonnative grasses. Other vegetation is to be allowed to grow naturally except on the dam and

dike embankments, where it is limited to grasses for safety considerations. Except for the dam and dike embankments, mowing, herbicide application or vegetation removal is prohibited. A strong grass root system must be maintained on the dam embankment.

(6) Brush piles were created on the mitigation areas to provide cover for upland species as part of the dam construction. These are to be left undisturbed.

(7) A monitoring program is to be implemented to monitor the success of the mitigation measures and to monitor the vernal pools affected by the project. This monitoring program is explained in Exhibit F of this document, (Exhibit F, Sheets 5 and 6 of 62.) Exhibit F provides the detailed monitoring plan.

8.3 LOCAL RESPONSIBILITIES

The Superintendent, or his representative, shall submit to the District Engineer an annual report covering the inspection and monitoring of the mitigation measures and environmental commitments as described in Exhibit F, Monitoring Plan for Environmental Commitments. This report is to be submitted with the Superintendent's annual report to the District Engineer.

CHAPTER 9 - SAFETY REQUIREMENTS

9.1 GENERAL

The Superintendent, or his representative, shall be responsible for ensuring that during the operation and maintenance of this project, no person shall be required to work under conditions, which are unsafe or dangerous to his/her health. The Superintendent, or his representative, shall be responsible for initiating and maintaining a health and safety program which will comply with the requirements of State and Federal health and safety laws to the extent applicable, and with the provisions of this manual. Each employee shall be provided initial indoctrination and such continued safety training to enable them to perform their work in a safe manner. During maintenance inspections, the Superintendent, or his representative, should also look for and identify any safety hazard, and then take immediate actions to rectify the problem.

9.2 GAGE HOUSE AND 48-INCH CMP WELL

The gage house and the 48-inch CMP well are considered enclosed and confined spaces and special safety requirements apply.

9.2.1 Safety Procedure

As part of the health and safety program developed by the Superintendent, a positive procedure for controlling or eliminating hazards in the enclosed and confined space shall be established. This procedure shall be in accordance with the U.S. Occupational Safety and Health Administration (OSHA) Permit/Required Confined Space for General Industry: Final Rule 29 CFR 1910.146. Any person entering an enclosed or confined space shall be properly instructed in the procedures. In addition, a copy of the procedures shall be posted outside the gage house door in a protected, laminated cover.

The safety procedure shall include the following:

(1) No one shall be alone when entering an enclosed space.

(2) Hazards considered shall include toxic material and vapors, flammable materials and vapors, asphyxiation, corrosive or radioactive materials, and lack of oxygen. Enclosed and confined spaces shall be tested for contaminants and periodic check tests shall assure a nonexplosive and safe breathable atmosphere.

(3) No one shall enter an enclosed space containing a known explosive atmosphere. If the atmosphere in a confined or enclosed space has oxygen deficiency or contamination sufficient to require respirator protection, any person

working in such a space shall have a safety harness and life line with an attendant. A signal system shall be established.

9.2.2 Respiratory Protection

No person shall be permitted in atmospheres containing less than 19.5 percent oxygen unless provided with a source of air. This air, as with air in all respirators, shall be free of harmful dusts, fumes, vapors, gases and obnoxious odors. Purity of the air shall meet U.S.P. or Compressed Gas Association Specification G7.1, grade D.

Canister masks shall be permitted only where the toxic content of the air is known to be of type and concentrations, which the mask will effectively remove. Where the type and concentration of the toxic content of the atmosphere is suspected but unknown, an air-supplied respirator shall be required for entry.

When respiratory protective equipment is required, a respiratory protection program shall be developed and implemented in accordance with ANSI Z 88.2. Medical status of individuals who are wearing respirators shall be evaluated.

CHAPTER 10 - OPERATION OF PHASE I PROJECT FEATURES

10.1 GENERAL OBJECTIVE

The purpose of Merced County Streams Phase I facilities (Castle Dam and Reservoir and the Main Canal Check Structure and turnouts) is to provide flood control. The flood season normally extends from 15 October to 15 April and can overlap the irrigation season, which can occur from 1 March to 31 October. Merced Irrigation District (MID) is entitled to divert water from the Merced River to its canal system during the irrigation season. The canal system includes, but is not limited to the Main Canal, Canal Creek, and Edendale Creek. Should MID need to start a new irrigation season before 15 April, close coordination will be required between MID, the Superintendent who will keep the State Reclamation Board, as represented by the Department of Water Resources, Division of Flood Management, informed to ensure that the respective operations are compatible and that the flood protection is not compromised.

10.1.1 Brief Description of the changes made to the Flood Control Facilities at the Castle Unit

This is in addition to the facilities described in Chapter 4, entitled "Features of Castle Dam and Appurtenances Unit".

a. The County of Merced Public Works Department and the Merced Irrigation District (MID) decided that the vertical trashrack in front of the vertical sluice gate should be removed because of its inefficiency. The vertical trashrack was removed and replaced with a new sloped trashrack. The Castle Dam outlet works (on the upstream side) was modified in early 1995 by extending concrete sloped walls approximately 7 feet further out into the reservoir. This allowed for a sloped steel trashrack to be constructed or anchored to the top of the concrete sloped walls that make up the inlet structure. For a more detailed description of the sloped trashrack, refer to the plan and profile on Plate 68 in the O&M manual. Two catwalks across the sloped trashrack allowed for the removal of any floating debris that was against the new trashrack. Castle Dam and the major diversion structures have telemetry equipment that allows MID to monitor and operate the entire system from a remote site (MID office). The telemetered system also allows MID to better monitor rapidly changing conditions and quickly respond to flood events. If the automated system fails refer to chapter 11.4, Emergency Operations for notification procedure.

b. The Edendale Creek Turnout Structure (located in the west levee embankment at Main Canal and Edendale Creek) was modified in March 1998 to increase flow conveyance through the Edendale Creek Turnout Structure. Three additional bays were added to the initial four bay structure so the turnout structure would have a total of 7 bays all equal (3.75' by 8'). The turnout was designed to

pass 1375 cubic feet second (cfs) at the turnout itself. The existing channel immediately downstream of the turnout (Edendale Creek) was widened to accommodate the new width of the turnout structure. Cut slopes with 1V on 2H were excavated as well as the existing channel invert. The newly shaped trapezoidal channel was then armored and the rock grouted in-place. An existing measuring weir located about 130 feet downstream of the turnout structure was replaced with a new concrete ogee structure with a stilling well located just upstream of the new measuring weir. Baffle blocks were constructed in the lower invert of the apron just downstream of the new weir crest to reduce the high energy in the water. The existing channel downstream of the new weir was widened to match the newly constructed concrete wing walls. Cut slopes of 1V on 2H were excavated as well and the existing invert of the channel was extended to daylight.

c. The bridge opening at Highway 59 and Edendale Creek was revised in early 1999 by lowering and widening the channel opening beneath the bridge crossing. The channel inverts and bridge abutments, upstream and downstream of the bridge, were also modified and armored with grout to match the new structural opening at Highway 59 bridge. This will prevent any scour and erosion at these critical sites, due to an increase in channel velocities. At the upstream end of the construction at Highway 59 and Edendale Creek, there is a railroad embankment that runs parallel with Highway 59. During high flows (wet years) water flows through a concrete *"U"* channel at this point and is approximately 5 feet in width. As a result, the velocity of the water is increased in this area because of the small cross sectional area of the of the existing *"U"* channel. This is the reason for the grouted rock in the channel invert on the upstream and downstream sides of Highway 59.

d. Another county bridge crossing at the Oakdale Road and Edendale Creek (wide box culvert) is an addition to the project and will be replaced under the LERRD's. The County of Merced Public Works Department is designing this bridge crossing. The Sacramento District will have a chance to review the plans and specifications during the preparation of the plans and specifications of the new bridge prior to the County advertising the job. The County of Merced Public Works Department will construct the proposed bridge crossing (approximately 50-feet in width).

10.1.2 Personnel to Contact in case Emergency Procedures are required

In case of an emergency involving Castle Dam and reservoir or any of the other design features of the Castle Dam Unit (Check Structure on Main Canal, revised Edendale Creek Turnout Structure on Main Canal, Canal Creek Turnout Structure on Main Canal, Highway 59 Bridge at Edendale Creek,) the responsible agencies and personnel to contact are shown in a listing at the end of Chapter 10. In case no personnel can be contacted, the California State Highway Patrol must be contacted at (916) 445-2895. ***Refer to emergency personnel listing at the end of Chapter 10 for the people to call incase of an emergency.***

10.2. OVERALL OPERATION

The following paragraphs refer to the operation of the various structures of the flood control project during flood season. During potential storm events the operating staff of MID shall be on alert and will report to the Superintendent (County of Merced Public Works Director) on an 8 hour or more frequent basis during potential flood events as referenced in 3.4.5.

10.2.1 Castle Dam and Reservoir

Castle Dam and Reservoir is gated and will require seasonal operation for flood control. The intake structure at Castle Dam has a bulkhead gate which can be raised to allow irrigation flows to pass or lowered to provide flood protection downstream of the dam. In the event that MID is utilizing Canal and/or Edendale Creeks and a storm event is imminent, MID shall curtail diversions from the Merced River to the Main Canal, and will fully close the bulkhead gate. After the storm event passes, and provided there is no further threat of storm activity, as determined by the Superintendent in consultation with MID, MID may adjust the bulkhead gate and resume irrigation flows as needed by use of Main Canal, Canal Creek, and Edendale Creek. MID will close the bulkhead gate at the end of irrigation season in preparation for flood season.

10.2.2 Edendale Creek Turnout on the Main Canal

Flood control operation is also required at the check structure and at each of the turnouts at Edendale Creek and Canal Creek along the Main Canal. The Edendale Creek turnout on the Main Canal has seven (7) turnout bays, all seven of which are gated. MID will open to full height and lock in place these seven turnout gates at the end of irrigation season. MID will close the 7 gates at the beginning of irrigation season. In the event that MID is utilizing Edendale Creek and a storm event is imminent, MID will immediately curtail any diversions from the Merced River to Main Canal, and will open to full height and lock in place the 7 turnout gates. After the storm event passes, and provided there are no further threats of storm activity, as determined by the Superintendent in consultation with MID, the 7 turnout gates will be closed, and MID may resume the use of the Main Canal. During the rest of the irrigation season, the gates will be operated by Merced Irrigation District for irrigation purposes. The modified turnout structure will pass a maximum flow of 1375 cfs. The area downstream of the modified turnout was riprapped along the existing invert and cutback slopes, beginning at the head works and proceeding downstream for approximately 130 feet. A new measuring weir was constructed at this location to replace the existing damaged weir. Riprap was placed along the existing invert and cutback slopes or banks to prevent scouring and erosion downstream of the new weir.

10.2.3 Canal Creek Turnout on the Main Canal

Four bays are located at the Canal Creek turnout on the Main Canal. The four bays will be opened to full height and locked in place at the end of irrigation season. MID will remove the stoplogs in the four bays and place one 2" by 12" stoplog on the stationary wall of each of the four bays (placed in a horizontal position) so that all four bays are open, but will maintain livestock water flows in the Main Canal. MID will replace the stoplogs in the four bays at the end of irrigation season. In the event that MID is utilizing Canal Creek and a storm event is imminent, MID will curtail diversions from the Merced River to the Main Canal, and remove the stoplogs in the four bays to allow flood water to pass through the Main Canal into Canal Creek. After the storm event passes, and provided there is no further threat of storm activity as determined by the Superintendent in consultation with MID, MID may replace the stoplogs in the four bays and may resume the use of Main Canal and Canal Creek. During the rest of the irrigation season, the gates will be operated by Merced Irrigation District for irrigation purposes.

10.2.4 Main Canal Check Structure

The Main Canal Check Structure has 10 bays with partial height steel gates incorporating stoplogs, which are placed on top of the steel gates to maintain winter flood control elevations. MID will close the 10 partial height steel gates and place stoplogs on top of the steel gates to winter flood control elevation at the end of irrigation season. One steel gate will be opened so that a maximum of 20 cfs can pass for livestock purposes. MID shall remove the stoplogs on the 10 partial height steel gates and will operate the steel gates as necessary to control irrigation flows. In the event that MID is utilizing the Main Canal and a storm event is imminent, MID shall curtail diversions to the Main Canal and close the 10 partial height steel gates and place stoplogs on top of the steel gates to the winter flood control elevation. Again leaving one steel gate open to pass a maximum of 20 cfs for livestock purposes. After the storm event passes, and provided there is no further threat of storm activity, as determined by the Superintendent in consultation with MID, MID may remove the stoplogs in the 10 partial height steel gates and will operate the steel gates as necessary to control irrigation flows during the rest of the year.

10.2.5 Parkinson Creek Turnout on the Main Canal

Operation of the Parkinson Creek turnout on the Main Canal is not part of the flood control project.

10.2.6 Fahrens Creek Turnout on the Main Canal

The Fahrens Creek turnout on the Main Canal has 12 bays, all of which are gated. During potential storm events, MID will monitor flows in the Main Canal and regulate

the Fahrens Creek turnout gates in conjunction with Yosemite Lake operations as needed for flood protection.

10.2.7 Yosemite Lake

As with the existing operation, Yosemite Lake flood releases will be made through the gated outlets on the Fairfield and LeGrand Canals. From 15 October until the start of irrigation season, these gates will be operated as needed for flood protection.

10.3 DEVIATIONS FROM OVERALL OPERATION

Deviations from the operational plan described above can be made at any time based on prevailing flood conditions. For example, if MID extends their irrigation season past 15 October, or start before 15 April, gate settings for irrigation flows would be different than the settings described in this manual for flood flows. Close coordination will be required between Merced Irrigation District, the Superintendent (County of Merced Public Works Director), The State Reclamation Board, and the State-Federal Flood Operation Center managed by the Department of Water Resources, Division of Flood Management to ensure that the respective operations are compatible and that the flood protection is not compromised. During emergency conditions, the operating agency may make changes based on conditions prevailing at the time which ensure the best overall flood protection objectives.

EMERGENCY LISTING

During Working Hours.

Paul A. Fillebrown, P.E.
Director of Public Works
County of Merced
715 Martin Luther King, Jr. Blvd.
Merced, CA 95340
(209)385-7602

Robert (Bob) Acker
MID-Dicretor of Facilities/Planning
720 West 20th Street
Merced, CA 95340
(209)722-5761

Steve Verigin, Chief, P.E.
Division of Safety of Dams
2200 "X" Street, Suite 200
Sacramemto, CA 95818
(916) 445-7606

State-Federal Flood Operation
Center
(800) 952-5330

Ricardo S. Pineda, Chief Engineer
State Reclamation Board
1426 Ninth Street, RM 1601
Sacramento, CA 94236
(916) 653-5440

Donald Yeoman, Chief Flood
Project Inspection Section
Department of Water Resources
1801 6th Street
Sacramento, CA 94236
(916) 445-4539

Hicham Eital
MID- Manger of Engineering
Water Resources
812 W. 18th Street
Merced, CA 95340
(209) 722-5761

After Working Hours, Weekends, & Holidays

1/
Paul Fillebrown, P.E.
Director of Public Works
Merced County
(209)723-3423

2/
CurtRoyer,AdministrativeEngineer
Merced County Public Works
(209) 722-8979

State – Federal Flood Operation
Center (800) 952-5330

Michel I. Zumot, P.E.
Area Engineer
Division of Safety of Dams
(916)385-2505

Ricardo S. Pineda, Chief Engineer
State Reclamation Board
(916) 485-9042

(cont. next page)
1/ Superintendent
2/ Superintendent's Representative

Donald Yeoman, Chief Flood
Project Inspection Section
Department Water Resources
(916) 442-8623

Hicham Eital
MID- Manager of Engineering
(209) 722-9743

<u>If Personnel Listed Above Can Not Be Reached</u>

If no one can be reached, plase call or notify the California State Highway Patrol at (916) 445-2895.

CHAPTER 11 NON-PROJECT MODIFICATIONS

11.1 GENERAL OBJECTIVE

This chapter deals with modifications to the project that are not part of the overall project. These modifications were made to improve control of the system for the Merced Irrigation District irrigation operations.

11.2 DESCRIPTION

A SCADA system was installed by the Merced Irrigation District (MID) for remote operations of the gates at Edendale Creek, Castle Dam and Main Canal. This system is operated from a remote operations center. Each site has back up battery power in case of power failure.

11.3 INSPECTIONS

Routine annual inspections are performed on the project features. During those routine inspections, the condition and operation of the SCADA system equipment shall be documented and results furnished to the Superintendent. The equipment shall be maintained and repaired/replaced by the Merced Irrigation District, as owners of the equipment.

11.4 EMERGENCY OPERATIONS

An Emergency Operations Plan shall be prepared to respond to flood situations if the SCADA system fails to perform during flood season. The Superintendent will notifiy the project sponsor of all SCADA equipment failures that impact the operation of the flood control features during flood season.

EXHIBIT A

CODE OF FEDERAL REGULATIONS
Title 33, Chapter II, Part 208
Flood Control Regulations
Navigation and Navigable Waters

CODE OF FEDERAL REGULATIONS (EXTRACT)

Title 33 - Navigation and Navigable Waters

Chapter II - Corps of Engineers, Department of the Army

Part 208 - Flood Control Regulations

Authority: §208.10 issued under Sec. 7, 58 Stat. 890; 33 U.S.C. 709.

§ 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 the 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.

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

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

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army 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 Department of the Army will furnish local interest with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

(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 sections 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 conditions;

(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;

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(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 ensure 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 wall, 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 head-walls 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 conditions.

(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 closures 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 therefore. 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 operations 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;

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(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 exceeding 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 therefore. (Sec 3.49 Stat 1571, as amended; 33 U.S.C. 3701C; 19 F R 9999, August 17, 1944. 9 F R 10203, August 22, 1944)

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PERMIT

_____
(Name of Levee Commission or City)

_____
(Location)

Permission is hereby granted to:

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

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

_____

_____

_____

_____

Provided That:

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

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

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

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

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

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

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

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

_____

_____

_____

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

_____	_____	_____
Signature (Grantor)	Title	Date

Approved:

Terms of this permit
are hereby accepted

_____	_____	_____	_____
Signature (Grantee)	Date		Date

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EXHIBIT B
LOCAL COOPERATION AGREEMENT
CASTLE DAM UNIT

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE STATE OF CALIFORNIA RECLAMATION BOARD
FOR
CONSTRUCTION OF FLOOD CONTROL DEVELOPMENT
OF
THE CASTLE DAM AND RESERVOIR UNIT
OF THE MERCED COUNTY STREAMS, CALIFORNIA PROJECT

THIS AGREEMENT, entered into this 30th day of November, 1988, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), (hereinafter referred to as the "Secretary"), and the State of California, Reclamation Board (hereinafter referred to as "the Local Sponsor"),

WITNESSETH, THAT:

WHEREAS, the construction of the Merced County Streams, California project (hereinafter referred to as the "MCSP") was authorized by Section 201 of the Flood Control Act of 1970 (Public Law 91-611), in accordance with the recommendations of the Chief of Engineers in his Report dated 25 November 1970; and,

WHEREAS, the 1985 Supplemental Appropriations Act, (Public Law 99-88), authorizes the Secretary of the Army to initiate construction of the MCSP under terms and conditions acceptable to him as set forth below; and,

WHEREAS, the Department of the Army and the State of California Reclamation Board entered into an Agreement on 27 June 1986 for construction of the MCSP; and,

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost-sharing requirements applicable to the MCSP; and,

WHEREAS, the Castle Dam and Reservoir Unit, hereinafter referred to as the "Project" is a separable element of the MCSP; and,

WHEREAS, a Feature Design Memorandum dated November 1981 for the Castle Dam and Reservoir Unit of the MCSP was approved by the Chief of Engineers on 25 June 1982, and presents the basis for final design of the Castle Dam and Reservoir Unit of the MCSP; and,

WHEREAS, the Local Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in project cost sharing and financing in accordance with the terms of this Agreement; and,

WHEREAS, the Local Sponsor has requested and been granted deferral of the initial year's cash requirement under the provisions of Section 103(1) of Public Law 99-662; and,

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WHEREAS, Section 103(1) of Public Law 99-662 requires that any deferral of the Local Sponsor's initial year's cash requirement be subject to interest charges for up to six months at a rate determined pursuant to Section 106 of Public Law 99-662:

NOW, THEREFORE, in consideration of the foregoing and the benefits that shall mutually accrue to the United States and the State of California by construction of the Castle Dam and Reservoir Unit of the MCSP, the parties agree as follows:

ARTICLE I - DEFINITIONS

For purposes of this Agreement:

1. The term "Project" shall mean construction of Castle Dam on Canal Creek consisting of a 2,050-foot long, zoned, earth-fill dam rising 40 feet above the stream bed; an ungated, riser-intake outlet works with conventional stilling basin; a 180-foot wide, concrete, low ogee, perched spillway located 1,400 feet north of the dam; two homogeneous-fill dikes ranging in height from 3 feet to 8.5 feet; and minor improvements on the Main Canal from Canal Creek to Fahrens Creek.

2. The term "total project cost" shall mean all costs incurred by the Local Sponsor and the Government directly related to construction of the Project. Such costs shall include, but not necessarily be limited to, actual construction costs including costs of alterations or relocations of railroad bridges and approaches, thereto and those portions of utilities that pass under or through the project structure; costs of applicable engineering and design; supervision and administration costs; costs of project construction contract dispute settlements and awards; and the value of lands, easements, rights-of-way, relocations, and material disposal areas provided for the Project by the Local Sponsor; but shall not include any costs for betterments or operation, maintenance, inspection, rehabilitation and replacement.

3. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time the Project is completed and accepted by the Contracting Officer.

4. The term "completion of the Project" shall mean that point in time when the Government turns the completed project over to the Local Sponsor.

5. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer District, Sacramento, or his designee.

6. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public or private road or way.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the Local Sponsor and appropriated by the Congress, shall expeditiously construct the Project (including alterations or relocations of railroad bridges and approaches thereto and those portions of utilities which pass under or through the project structure), applying those procedures usually followed

or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The Government shall use its best effort to secure continued funding and the scheduled completion of project construction.

b. The Local Sponsor shall be afforded the opportunity to review and comment on all designs and contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The Local Sponsor also shall be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government shall consider adjustments to the project construction schedule when so requested by the Local Sponsor. The Government will consider the views of the Local Sponsor, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

c. Following the period of construction, the Government shall turn the completed Project over to the Local Sponsor, which shall accept the Project and be solely responsible for operating, maintaining, inspecting, replacing, and rehabilitating the Project in accordance with Article VIII - OPERATION, MAINTENANCE, INSPECTION, REPLACEMENT, AND REHABILITATION, hereof.

d. As further specified in Article VI - METHOD OF PAYMENT, hereof, the Local Sponsor shall provide during the period of construction a cash contribution of 5 percent of the total project cost.

e. As further specified in Article III - LANDS, FACILITIES AND, RELOCATION ASSISTANCE hereof, the Local Sponsor shall provide all lands, easements, rights-of-way, and material disposal areas, and perform all relocations and alterations of buildings, utilities other than those portions that pass under or through the project structure, highways, railroads (except railroad bridges and approaches thereto), bridges (except abutments and additional footings that are structural and integral to the Project), sewers, and related and special facilities determined by the Government to be necessary for construction of the Project. Aerial facilities, supported by poles or other means, which, if damaged, would not normally cause adverse effects to the project structure, will be paid for by the Local Sponsor.

f. If the value of the contributions provided under paragraphs d. and e. of this Article represents less than 25 percent of the total project cost, the Local Sponsor shall provide during the period of construction, an additional cash contribution in the amount necessary to make its total contribution equal to 25 percent of the total project cost.

g. No less than once each year following completion of the Project the Local Sponsor shall inform affected interests of the degree of the protection afforded by the Project.

h. Following completion of the Project, the Local Sponsor shall publicize floodplain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels

provided by the Project.

i. Following completion of the Project, the Local Sponsor shall, to the extent of its powers, prescribe and enforce regulations to prevent any obstruction of or encroachment on the Project that would reduce the designed level of flood protection provided or that would hinder operation, maintenance, inspection, replacement, or rehabilitation of the Project. In addition, the Local Sponsor shall preserve or restore and thereafter maintain channels and diversion-of-flow structures required for conveyance of floodwaters within the project area to at least those capacities specified for the flood control system operation plan defined in the Water Control Manual. The capacity of the reach of Canal Creek between Castle Dam and Black Rascal Creek shall be maintained to a capacity of 400 cfs. The Government shall provide the Water Control Manual to the Local Sponsor upon completion of the Project.

j. The Local Sponsor shall adjust all claims regarding water rights that might be affected by the Project.

k. The Local Sponsor shall provide for continued diversion of up to 1,000 cfs of the flood flows of Faherns Creek at the Merced Irrigation District Main Canal into Yosemite Lake.

l. No Federal funds may be used to meet the Local Sponsor's share of total project costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified by the granting agency.

ARTICLE III - LANDS, FACILITIES, AND RELOCATION ASSISTANCE

a. Prior to the advertisement of any construction contract, the Local Sponsor shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and material disposal areas, as may be determined by the Government to be necessary for construction of the Project and related operation and maintenance of the Project and shall furnish to the Government evidence supporting the Local Sponsor's legal authority to grant rights-of-entry to such lands.

b. Upon notification from the Government, the Local Sponsor shall accomplish or arrange for accomplishment at no cost to the Government of all alterations and relocations of buildings, highways, railroads (except railroad bridges and approaches thereto), bridges (except abutments and additional footings that are structural and integral to the Project), storm drains, utilities (other than those portions that pass under or through the project structure), cemeteries, and other facilities, structures and improvements determined by the Government to be necessary for construction of the Project.

c. The Local Sponsor shall comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, in acquiring lands, easements, and rights-of-way for construction and subsequent operation, maintenance, inspection, replacement and rehabilitation of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way that will be included in the total project cost and credited toward the Local Sponsor's share of the total project cost will be determined in accordance with the following procedures:

1. If the lands, easements, or rights-of-way are owned by the Local Sponsor as of the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the Project. The fair market value shall be determined by an appraisal, to be obtained by the Local Sponsor, which has been prepared by an independent and qualified appraiser who is acceptable to both the Local Sponsor and the Government. the appraisal shall be reviewed and is subject to approval by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the Local Sponsor after the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the Project. The fair market value shall be determined as specified in subparagraph 1 above. If the Local Sponsor pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the Local Sponsor has secured prior written approval from the Government of its offer to purchase such interest.

3. If the Local Sponsor acquires more lands, easements, or rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in the total project cost and credited to the Local Sponsor's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which occur within a one-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior Government approval.

5. For lands, easements, or rights-of-way acquired by the Local Sponsor within a five-year period preceding the date this Agreement is signed, or any time after this Agreement is signed, credits provided under this Article will also include the actual, incidental costs of acquiring the interest, e.g., closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with the obligations under this Agreement.

b. The costs of relocations or modifications of utilities (other than those portions which pass under or through the project structure) or facilities that will be included in the total project cost and credited toward the Local Sponsor's share of the total project cost shall be that portion of the actual costs incurred by the Local Sponsor as set forth

below:

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of California would use in constructing a new bridge or highway under similar conditions of geography and traffic loads. Abutments and additional footings which are structural and integral to the Project are to be considered part of the Project and cost shared in the same proportion as the total project cost.

2. Utilities and Facilities (including Railroads, except Railroad Bridges and Approaches): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any relocation or alteration if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in the total project cost.

ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the Local Sponsor and the Government during the period of construction, the Local Sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project.

b. The representatives appointed above shall meet as necessary during the period of construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE VI - METHOD OF PAYMENT

a. The Local Sponsor shall provide, over the period of construction, the cash amounts required under Article II.d. and II.f. - OBLIGATIONS OF THE PARTIES of this Agreement together with the interest required under Section 103(1) of the Water Resources Development Act of 1986 (Public Law 99-662). The total project cost presently is estimated to be $8,650,000. In order to meet its share, the Local Sponsor must provide a total cash contribution presently estimated to be $432,500 and the interest charges presently estimated to be $10,370.

b. The Local Sponsor will defer its first-year cash requirement including the Local Sponsor's proportionate payment of Preconstruction Engineering and Design costs, plus interest charges, which will be due and payable eleven months after the date of award of the first construction contract.

c. The Local Sponsor shall provide its remaining cash contribution exclusive of the deferred initial payment in quarterly payments and in proportion to the rate of Federal annual expenditures over the period of construction in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the Local Sponsor by May first of each year of the estimated funds that will be required from the Local Sponsor each quarter to meet its share of project costs for the following Government fiscal year.

2. For the second and subsequent Government fiscal years of project construction, the Government shall, 60 calendar days prior to the beginning of the Government fiscal year, notify the Local Sponsor of its share of project costs, for each quarter of that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the Local Sponsor shall deliver the first quarter's payment by check to the Finance and Accounting Officer, U.S. Army Corps of Engineers, Sacramento District, at the address specified in Article XVII - NOTICES. The second, third and fourth quarterly payments shall be made by the Local Sponsor in the same manner within thirty (30) calendar days before the first day of the respective quarters (January, April and July).

3. If at any time during the period of construction the Government determines that additional funds will be needed from the Local Sponsor to meet its required share of project costs, the Government shall so notify the Local Sponsor and the Local Sponsor, within 90 calendar days from receipt of notice, shall make the necessary funds available through the funding mechanism specified in paragraph c.2. above, or make the necessary funds available on a schedule acceptable to the Contracting Officer.

d. The government will draw on the funds provided by the Local Sponsor such sums as it deems necessary to cover contractual and in-house fiscal obligations attributable to the Project as they are incurred, as well as project costs incurred by the Government prior to the initiation of construction. As construction of the Project proceeds, the Government may adjust the amounts required to be provided under this paragraph to reflect actual project costs.

e. Upon completion of the Project and resolution of all relevant contract claims and appeals, the Government shall compute the total project cost and tender to the Local Sponsor a final accounting of its share of the total project cost. In the event the total contribution by the Local Sponsor is less than its minimum required share of the total project cost at the time of the final accounting, the Local Sponsor shall, within 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet its minimum required share of the total project cost. In the event the Local Sponsor has made cash contributions in excess of 5 percent of the total project cost, which results in the Local Sponsor having provided more than its required share of the total project cost, the Government shall within 90 calendar days of the final accounting, subject to the availability of appropriations, return said excess to the Local Sponsor; however, the Local Sponsor shall not be entitled to any refund of the 5 percent cash contribution required pursuant

to Article II.e. - OBLIGATIONS OF THE PARTIES hereof. If the Local Sponsor's total contribution under this Agreement (including lands, easements, rights-of-way, relocations, and material disposal areas provided by the Local Sponsor) exceeds 50 percent of the total project cost, the Government shall, subject to the availability of appropriations, refund the excess to the Local Sponsor within 90 calendar days of the final accounting.

ARTICLE VII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VIII - OPERATION, MAINTENANCE, INSPECTION, REPLACEMENT, AND REHABILITATION

a. Upon completion of the Project, the Local Sponsor shall operate, maintain, inspect, replace, and rehabilitate the Project in accordance with the written regulations or directions prescribed by the Government.

b. The Local Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls, for access to the Project and for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, maintaining, replacing or rehabilitating the Project. If an inspection shows that the Local Sponsor for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the Local Sponsor. If the Local Sponsor persists in such failure for 30 calendar days after receipt of the notice or fails to provide adequate assurances for fulfilling its obligations herein, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the Local Sponsor owns or controls, for access to the Project for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the Project. No inspection, completion, operation, repair, maintenance, replacement, or rehabilitation by the Government shall operate to relieve the Local Sponsor of the responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE IX - RELEASE OF CLAIMS

The Local Sponsor shall hold and save the Government free from all damages arising from the construction, operation, maintenance, inspection, replacement and rehabilitation of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS

The Government and the Local Sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred

pursuant to this Agreement to the extent and in such detail as will properly reflect the total project cost. The Government and the Local Sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of the Project and resolution of all claims arising therefrom, and shall make available at their offices in California at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Local Sponsor agrees to comply with all applicable Federal and state laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - COVENANT AGAINST CONTINGENT FEES

The Local Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Local Sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XV - TERMINATION OR SUSPENSION

a. If at any time the Local Sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the Project until the Local Sponsor is no longer in arrears, unless the Secretary determines that continuation of work on the Project is in the interest of the United States. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on

which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations for the Project in amounts sufficient to meet project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Local Sponsor. After 60 calendar days either party may elect without penalty to terminate this Agreement or to defer future performance hereunder; however, deferral of future performance under this Agreement shall not affect existing obligations or relieve the parties of liability for any obligation previously incurred. In the event that either party elects to terminate this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI - METHOD OF PAYMENT of this Agreement. In the event that either party elects to defer future performance under this Agreement, such deferral shall remain in effect until such time as the Government receives sufficient appropriations or until either party elects to terminate this Agreement.

c. Notwithstanding any other provision of this Agreement, if the award of any contract for construction of the Project would result in the total obligations and expenditures for construction of the Project exceeding $10,400,000, the award of that contract and subsequent contracts shall be deferred until such times as both parties to this Agreement agree to resume construction of the Project.

ARTICLE XVI - OBLIGATION OF FUTURE APPROPRIATIONS

Nothing herein shall constitute or be deemed to constitute, an obligation of future appropriations by the legislature of the State of California.

ARTICLE XVII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage-prepaid), registered, or certified mail, as follows:

If to the Local Sponsor:

Reclamation Board
1416 Ninth Street, Room 455-6
Sacramento, California 95814

If to the Government:

U.S. Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814-4794

b. A party may change the address to which such communications are to

be directed by giving written notice to the other in the manner provided in this Article.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.

ARTICLE XVIII - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIX - PRIOR AGREEMENTS

This Agreement supersedes and replaces the Agreement entered into between the Department of the Army and the State of California Reclamation Board executed on 27 June 1986 for construction of the Merced County Streams, California flood control project.

ARTICLE XX - ABILITY TO PAY

The Project does not qualify for a revision to the non-Federal cost share for flood control based on estimated flood control benefits and costs and on application of guidelines published as Flood Control Cost Sharing Requirements Under the Ability to Pay Provision; Interim Final Rule (Vol. 52 Federal Register pages 35872-35892, 1987 codified at (33 CFR, Sections 241.1-.6)), implementing Section 103(m) of the Water Resources Development Act of 1986.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY

BY: _____
ROBERT W. PAGE
Assistant Secretary of the Army
(Civil Works)

DATE: 11 30-88

THE RECLAMATION BOARD

BY: _____
WALLACE MC CORMACK
President

DATE: 11-4-88

ATTEST: _____

DATE: 11/4/88

CERTIFICATE OF AUTHORITY

I, Denis G. Rose, do hereby certify that I am the Counsel for the Reclamation Board, the Reclamation Board is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Reclamation Board in connection with the Merced County Streams, California Project and pay damages, if necessary, in the event of the failure to perform in accordance with Section 221 of Public Law 91-611, and that the persons who have executed the Agreement on behalf of the Reclamation Board have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed the Certificate this 4th day of November, A.D., 1988.

Denis G. Rose
Counsel, Reclamation Board

WITNESSES:

COL, US ARMY

MAJ(A) US Army

WITNESSES:

AMENDMENT 1 TO THE AGREEMENT
BETWEEN
STATE OF CALIFORNIA, THE RECLAMATION BOARD
AND
COUNTY OF MERCED

CASTLE DAM AND RESERVOIR UNIT OF THE
MERCED COUNTY STREAMS, CALIFORNIA PROJECT

This document is an amendment to the Local Cost Sharing Agreement (LCSA) between The Reclamation Board of the State of California and the County of Merced, for the Castle Dam Project, executed on the 4th day of November, 1988. A copy of the LCSA is attached to this amendment as Attachment 1. The following items are hereby amended:

Recitals:

1. Replace recital item #5. with:

   "Due to the passage of Senate Bill 502, (Stats. 1988, Ch. 1251) resulting in the addition of California Water Code Section 12585.5, and the subsequent request by the County, the provisions contained within shall govern in determining the respective Board and County shares of the nonfederal share of the total project cost of the Castle Dam and Reservoir Unit of the authorized MCSP."

Agreements:

1. Replace agreement item #3. with:

   "The Board will pay 70 percent of the nonfederal share of the total project cost pursuant to the provisions of the California Water Code, Section 12585.5, and as defined in Article II.d., e., f., Article III., and Article IV. of the LCA between the Government and the Board (Exhibit A.)"

2. Delete agreement item #4.

3. Delete agreement item #5.

4. Replace agreement item #7.d.i. with:

   "To provide 30 percent of the costs of the nonfederal share of the total project cost pursuant to the provisions of Water Code Section 12585.5 and as defined in Article II.d., e., f., Article III., and Article IV. of the LCA between the Government and the Board (Exhibit A.)"

5. Delete agreement items #7.d.ii., iii, and iv.

MERCED COUNTY CONTRACT NO. 6863

6. Replace agreement item #10. with:

"If the County fails to make timely cash payments as required in 7.d.i. above, it is recognized that the Board has no authority to pay or to advance to the Government on behalf of the County the cash contribution required pursuant to P.L. 99-662, Sections 103 (a) (1) (A) and 103 (a) (2), and the Project will be subject to suspension and/or termination under the provisions of Article XV of the LCA between the Government and the Board (Exhibit A)."

7. Replace agreement item #11. with:

"Notwithstanding the above, if the Board fails to provide the real estate interests or relocation, or to make timely payments as collectively referred to in Sections 2., 3., and 8. of this Agreement, then the County will be relieved of all obligations to pay the penalty associated with the Board's default under the terms and conditions of Article XV (a) of the LCA between the Government and the Board (Exhibit A)."

IN WITNESS WHEREOF, the parties hereto have executed this Amendment effective as of the last date of execution below.

COUNTY OF MERCED

By Ann Klinger

CHAIRMAN
Board of Supervisors

ATTEST:

By B Chedin

Merced County Counsel

Date: 9-15-92

STATE OF CALIFORNIA
THE RECLAMATION BOARD

By Walker McConnell

PRESIDENT
The Reclamation Board

Approved as to legal form and sufficiency

By [illegible]

COUNSEL
THE RECLAMATION BOARD

Date: 9-18-82

Attachment 1

AGREEMENT
BETWEEN
STATE OF CALIFORNIA
THE RECLAMATION BOARD
AND
COUNTY OF MERCED

CASTLE DAM AND RESERVOIR UNIT OF THE
MERCED COUNTY STREAMS, CALIFORNIA PROJECT

This Agreement is made and entered into by and between The Reclamation Board of the State of California, hereinafter referred to as the "Board", and the County of Merced, hereinafter referred to as the "County", on the 4th day of November, 1988, in view of the following circumstances:

RECITALS:

1. The Merced County Streams, California Flood Control Project, hereinafter referred to as the "MCSP", was authorized by Act of Congress on December 31, 1970 (Public Law 91-611), approving recommendations of the Chief of Engineers in his report dated November 25, 1970;

2. Federal construction authorization is contained in the provisions of Chapter 20 of P.L. 99-88, "The Supplemental Appropriations Act of 1985";

3. In 1974, the State of California, hereinafter referred to as the "State", authorized cooperation on the MCSP (Section 12667 of the California Water Code) and authorized the Board to give satisfactory assurances to the Department of the

Army, hereinafter referred to as the "Government", that the required local cooperation will be furnished by the State in connection with the MCSP;

4. In 1986, the State amended Section 12667 of the Water Code to affirm that the MCSP is a project of the Merced County Streams Group as defined and excepted in Section 12826 of the Water Code, and that the Board is authorized to loan the County the necessary funds required by the County to pay its share of the cost of purchasing lands, easements, and rights of way under terms and conditions as specified in Sections 12585.2 and 12585.4 of the Water Code;

5. The timely passage of Senate Bill 502, pending in the State Legislature, or similar legislation, will provide an alternative to Section 12585.2 of the Water Code for the determination of the respective Board and County cost share of the Castle Dam and Reservoir Unit of the authorized MCSP;

6. It is the intention of the Government, the Board, and the County to immediately commence with construction of the Castle Dam and Reservoir Unit of the authorized MCSP;

7. It is further the intention of the Government, the Board, and the County to proceed with the construction of the remainder of the MCSP, with such remaining portion subject to a future assurance agreement;

8. The County has the power and authority to do all things required of the nonfederal interests for the MCSP;

9. The nonfederal share of the total project cost is defined in Article II.d., e., f., Article III., and Article IV. of the Local Cooperation Agreement (LCA) between the Government and the Board for construction of flood control development for the Castle Dam and Reservoir Unit of the MCSP, which is to be executed subsequent to this Agreement and is appended hereto as Exhibit A; and

10. The parties recognize that their prior agreement of June 27, 1986, Merced Contract No. 5850, has been nullified with federal passage of P.L. 99-662, the "Water Resources Development Act of 1986" and is therefore without force and effect,

NOW, THEREFORE, IT IS HEREBY AGREED:

1. The Board will provide the assurances of nonfederal cooperation required by the Government for the Castle Dam and Reservoir Unit of the MCSP, hereinafter referred to as "Project".

2. The Board will furnish to the Government, according to the terms and conditions of Article III of the LCA between the Government and the Board (Exhibit A), those lands, easements, rights of way, and relocations determined by the

Government to be needed for the construction, operation, and maintenance of the Project.

3. The Board will pay 75 percent of the costs of Project lands, easements, and rights of way, and 90 percent of the costs of relocations, pursuant to the provisions of Water Code Sections 12585.2 - 12585.4 and 12667.

4. Upon the written request of the County and execution of a Loan Agreement, the Board, pursuant to Sections 12585.2 - 12585.4 and 12667 of the Water Code, will loan the County funds necessary to satisfy the County's obligations under Section 7.d.ii. of this Agreement. The principal amount of the Loan will be comprised of the funds loaned, plus interest capitalized during the construction period. Interest capitalized during the construction period shall accrue at the then current State's Surplus Money Investment Fund rate on any funds expended or advanced by the Board on behalf of the County from the date such funds are expended or advanced to the initiation date of the Loan. The rate of interest on the Loan shall be the current rate for the State's Pooled Money Investment Account. The loan agreement shall be executed prior to disbursement of any loan proceeds by the Board to the Government on behalf of the County.

The Loan shall be repaid in equal annual installments over a ten-year period beginning one year after the initiation date of the Loan. The initiation date of the Loan for repayment

purposes shall be the date that responsibility for the completed Project is transferred from the Government to the Board. If the County defaults on any State loan authorized pursuant to this agreement, the annual loan payments may be deducted from the State's annual tax subvention to the local agency, if any.

Any State loan incurred by the County pursuant to this Agreement must be paid in full before the County may switch to funding pursuant to SB 502 of 1988, should that Bill or similar legislation be enacted into law.

5. Upon the passage of SB 502 or similar legislation and upon written request by the County, the Parties agree to amend this Agreement to provide that the Board shall pay in lieu of the 75 percent of the lands, easements, and rights of way and 90 percent of the relocations as identified in Section 12585.2 of the Water Code, an amount equal to that specified in the legislation as finally adopted and codified in the Water Code.

6. Upon completion of the Project, the Board shall turn the completed Project, including all associated lands acquired by the Board, or on behalf of the Board, over to the County.

7. In consideration therefore, the County agrees:

a. To hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project except for damages due to the fault or negligence of the Government or its contractors;

b. To maintain and operate the facilities and related features of this Project in accordance with the regulations or directions prescribed by the Secretary of the Army;

c. To hold and save the Board, its successors or assigns, free and harmless from any and all claims arising out of or in connection with the aforesaid obligations assumed by the County, including any responsibility for damages arising out of work performed by the Government pursuant to Section 221 of P.L. 91-611 and Section 7.a. of this Agreement;

d. To do all things and meet all obligations of the Board, including the establishment of priorities within its budget structure to provide funding sufficient to meet the financial obligations of the Board, as prescribed in the LCA between the Government and the Board (Exhibit A), to the extent they are specifically and otherwise provided for herein:

i. To provide a minimum of five percent of the total allocated flood control Project costs in cash as required by the Secretary of the Army pursuant to terms and conditions contained within the Federal "Water Resources Development Act of 1986", P.L. 99-662, November 17, 1986, Section 103 (a)(1)(A);

ii. To provide 25 percent of the costs of Project lands, easements, and rights of way, and 10 percent of the costs of relocations, pursuant to the provisions of Water Code Sections 12585.2 and 12667;

iii. In addition to 7.d.i. and ii. above, to provide that additional cash necessary to meet the 25 percent minimum nonfederal contribution towards the allocated flood control costs as required in the Federal "Water Resources Development Act of 1986", P.L. 99-662, November 17, 1986, Section 103 (a)(2); and

iv. Upon passage of SB 502 or similar legislation and upon written request of the County, the Parties agree to amend this Agreement to provide that the County shall pay an amount, in lieu of that expressed in Subsections 7.d.i., ii., and iii. above, equal to such amount as identified as the County's share of the nonfederal cost.

8. The Parties agree to pay their respective share of Project costs in accordance with Article VI "Method of Payment" of the LCA between the Government and the Board (Exhibit A).

9. The current "Government Cost Estimate" (Table 1) and accompanying "Funding Schedules" (Tables 2A, 2B, 2C, and Tables 3A, 3B, and 3C) for the Castle Dam and Reservoir Unit of the MCSP are appended hereto and made a part of this Agreement by this reference.

10. If the County fails to make timely cash payments as required in 7.d.i. and iii above, it is recognized that the Board has no authority to pay or to advance to the Government on behalf of the County the cash contribution required pursuant to P.L. 99-662, Sections 103 (a)(1)(A) and 103 (a)(2), and that the Project will be subject to termination or suspension under the provisions of Article XV of the LCA between the Government and the Board (Exhibit A).

11. Notwithstanding the above, if the Board fails to provide the real estate interests or relocations, or to make timely payments as collectively referred to in Sections 2 through 5 and in Section 8 of this Agreement, then the County will be relieved of all obligations to pay the penalty associated with the Board's default under the terms and conditions of Article XV(a) of the LCA between the Government and the Board (Exhibit A).

12. The Parties shall, upon completion or termination of the Project, provide an accounting of all costs incurred and credits claimed hereunder.

13. The Parties agree and stipulate that nothing herein shall constitute, or be deemed to constitute, an obligation of future appropriations by the Legislature of the State or the Board of Supervisors of the County.

14. The term of this Agreement shall be coextensive with the LCA between the Government and the Board (Exhibit A).

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement as of the day and year first above written.

COUNTY OF MERCED

By _____
CHAIRMAN
Board of Supervisors

ATTEST:

By _____
Merced County Counsel

Date: 11/4/88

WITNESSES:

_____

_____

_____

STATE OF CALIFORNIA
THE RECLAMATION BOARD

By _____
PRESIDENT
The Reclamation Board

ATTEST:

By _____
COUNSEL
The Reclamation Board

Date: 11/4/88

_____

_____

_____

WITNESSES:

I hereby certify that all conditions for exemption set forth in State Administrative Manual Section 1209 have been complied with and this document is exempt from review by the Department of Finance.

Signature

Merced Stream Group

Rob Swan D-A
Mike Jeff S.
File

Programs and Project Management
Division

JAN 27 2000

The Reclamation Board
State of California
1416-9th Street, Room 455-6
Sacramento, California 95814

Members of the Board:

You are hereby notified that the Corps of Engineers has completed the Edendale turnout structure on Edendale Creek under the authority of Section 201 of the Flood Control Act of 1970 (Public Law 91-611).

The completed functional work consists of the enlargement of the turnout structure on Edendale Creek from four gates to seven gates and repair of the access road under contract DACW05-98-C-0006; work was completed on March 24, 1998. Modifications to the Highway 59 Bridge Crossing with Edendale Creek were made under contract DACW05-98-P-0168 and completed on March 13, 1999. Restoration of Edendale Creek Upstream of the Highway 59 Bridge Crossing at the Old Railroad Crossing under contract DACW05-99-P-0217 was completed on March 13, 1999. With the completion of this work, the Castle Dam Unit is complete. Any modification to the irrigation pipe, which crosses Edendale Creek below the turnout structure, is considered a utility relocation and is a local project cost. The Oakdale Bridge is undersized and the replacement is scheduled for the future. The Environmental Assessment for the bridge is currently being circulated. The replacement of the bridge is considered a utility relocation and is a local project cost.

The completed work is hereby transferred to the State of California as of the date of this letter for operation and maintenance in accordance with the Local Cooperation Agreement signed on November 30, 1988 and Code of Federal Regulations, Title 33, Part 208, Flood Control Regulations.

The completed work will be operated and maintained in accordance with the Local Cooperation Agreement between the Department of the Army and the State of California dated November 30, 1988. An Operation and Maintenance Manual has been prepared, coordinated and will be furnished to your office when printed.

Merced County Streams - Castle Dam Exhibit B

Should you have any questions regarding this letter, please feel free to contact our Merced County Streams Project Manager, Ms. Judy Soutiere, at (916) 557-7397.

Sincerely,

Michael J. Walsh
Colonel, Corps of Engineers
District Engineer

Copies Furnished:
Mr. Paul Fillebrown, Director, Merced County, Department of Public Works, 715 Martin Luther King Jr. Way, Merced, CA 95340-6041
Department of Water Resources, ATTN: K. Finch, 1416 Ninth Street, Sacramento, California 95814

CDR, SPD, ATTN: CESPD-CO-O
CDR, USACE, ATTN: DAEN-CECW-OM

file: K/pub/admin ltrs/Soutiere- draft turn over report 01-21-00)

Cc:
CESPK-PM-C (Soutiere,K.Clark)
CESPK-RM
CESPK-CO
CESPK-CO-R

1/24/00
SOUTIERE/PM-C
MACK/PM-C
SANDERS/CO-O
1/24
NOLAN/CO
DURHAM-AGUILERA/CO
MULLER/ED-D
WORSTALL/OC
CHARLTON/DD-P
OBRIEN/DD
WALSH/DE

Merced County Streams - Castle Dam Exhibit B

EXHIBIT C
ANNUAL REPORT FORM

To: The District Engineer
Sacramento District
Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Dear Sir:

The annual report for the period (_____ 19___ to _____ 19___) on the project, Castle Dam and Main Canal Check Structure, Merced County Streams, Phase I, is as follows:

a. The physical condition of the protective works is indicated by the inspection reports, copies of which are enclosed, and may be summarized as follows:

(Superintendent's summary of conditions)

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

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

b. During this report period, major high water periods (reservoir level at elevation 200.0 or higher) occurred on the following dates:

Date	Max. Elevation
_____	_____
_____	_____
_____	_____

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

(Superintendent's log of flood observations)

During the high reservoir stage when the reservoir reached elevation 200.0 or in excess thereof (dates)_____ it was necessary to organize and carry on flood operations as follows:

(See Maintenance Manual, paragraph 5.3)

EXHIBIT C
SHEET 1 OF 2

31

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

Action or prosecution for abatement of these encroachments or trespasses are summarized as follows: (or state none have been necessary)

Action or prosecution for abatement of these encroachments or trespasses are summarized as follows: (or state that none have been necessary)

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

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

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

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

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

	Labor	Material	Equipment	Overhead	Total
1. Inspection					
2. Maintenance and Operation					
3. Flood-Fighting Operations					
Total					

Note: Also attached are the required submittals on instrumentation readings, environmental commitment inspections, and vernal pool monitoring.

Respectfully Submitted

_____

Superintendent

EXHIBIT C
SHEET 2 of 2

EXHIBIT D
CHECK LIST

(1) Dam & Dike Embankment
(2) Channels & Reservoirs
(3) Outlet Works & Recorder Stations
(4) Instrumentation

CHECK LIST NO. 1
DAM AND DIKE EMBANKMENTS

Inspector's Report Sheet No. _____ Date _____

Item	Remarks
(a) Name of dike and location by station	
(b) Settlement, sloughing or loss of grade	
(c) Condition of riprap protection	
(d) Condition of sod cover	
(e) Condition of roadways including ramps	
(f) Evidence of seepage	
(g) Condition of toe drains	
(h) Condition of farm gates and fencing	
(i) Maintenance measures taken since last inspection	
(j) Measured flow from relief wells (GPM)	
(k) Condition of observation well	
(l) Comments	

_____
Inspector

_____
Superintendent

EXHIBIT D
SHEET 1 OF 8

Instructions for completing sheet 1, Exhibit D

Item (a)	Indicate name of dam or dike and show station of observation obtained by pacing from nearest reference point.
Item (b)	If sufficient settlement of earth work has taken place to be noticeable by visual observation, indicate amount of settlement in tenths of a foot. If sloughing has caused a change in slope of the embankment sections, determine new slope. Note areas where erosion or gullying of the section has occurred.
Item (c)	State any change that has taken place in the riprap such as disintegration of rock, erosion or sliding of rock down the face. Indicate size and character of vegetation that may have grown up through the riprap. Note the presence of any drift or debris.
Item (d)	Note condition of seeded areas and indicate if there has been inappropriate burning of grass or unauthorized grazing.
Item (e)	Note any material change in grade and section of roadway and ramps. Indicate any inadequacy in surface drainage system.
Item (f)	Indicate any evidence of seepage through the embankment sections particularly around the toe drains.
Item (g)	Indicate if downstream toe drains are functioning and if silt is decreasing their efficiency.
Item (h)	Indicate the serviceability of all farm gates across the embankment roadway and indicate if repainting is required. Note any damage to posts, fencing and barbed wire.
Item (i)	Indicate maintenance measures that have been performed since last inspection and their condition at time of this inspection.
Item (j)	Record opinion, if any, of contributory causes for conditions observed, and also any observation not covered under other columns.
NOTE:	One copy of the Inspector's Report is to be mailed to the District Engineer immediately upon completion, and one copy is to be attached to and submitted with the Superintendent's annual report.

CHECK LIST NO. 2
CHANNELS AND RESERVOIRS

Inspector's Report Sheet No. _____ Date _____

	Item	Remarks
(a)	Name of channel and location by station	
(b)	Vegetal growth in channel	
(c)	Debris and refuse in channel or reservoir	
(d)	New construction within rights-of-way	
(e)	Extent of aggradation or degradation	
(f)	Condition of staff gages	
(g)	Condition of riprapped section	
(h)	Condition of concrete lined section	
(i)	Condition of road crossings	
(j)	Maintenance measures taken since last inspection	
(k)	Comments	

_____
Inspector

_____
Superintendent

Instructions for completing sheet 3, Exhibit D

Item (a)	Indicate name of channel and show station of observation obtained by pacing from nearest reference point.
Item (b)	Note nature, extent, and size of vegetal growth within the limits of the flood flow channel.
Item (c)	Note nature and extent of debris and refuse that might cause clogging of the conduits of the outlet works, the road culverts or bridge.
Item (d)	Report any construction along the channel or in the reservoir area that has come to the attention of the inspector and that might affect the functioning of the project.
Item (e)	Indicate any changes in the grade or alignment of the channels, either deposition or sediments or scour, that is noticeable by visual inspection. Estimate amount and extent.
Item (f)	Note any damage that may have occurred to the staff gages since the last inspection.
Item (g)	Indicate any change that has taken place in the riprap such as disintegration of the rock, erosion or movement of the rock. Note the presence of vegetal growth through the riprap.
Item (h)	Record condition of concrete lining with particular attention given to settlement cracks, spalls, abrasive wear and condition of construction joints.
Item (i)	Indicate amount of debris and other obstructions to flow; note any settlement cracks, spalls, abrasive wear and condition of construction joints.
Item (j)	Indicate maintenance measures that have been performed since the last inspection and their condition at time of this inspection.
Item (k)	Record opinion, if any, of contributory causes for conditions observed, and also any observations not covered under other columns.
NOTE:	One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's annual report.

CHECK LIST NO. 3
OUTLET WORKS AND RECORDER STATIONS

	Item	Remarks
(a)	Name of structure and location	
(b)	Debris or obstructions to flow	
(c)	Damage or settlement of conduits or structures	
(d)	Condition of concrete	
(e)	Condition of riprapped intake and outlet sections	
(f)	Condition of control gates and accessories	
(g)	Condition of access bridges	
(h)	Condition of gaging facilities	
(i)	Corrective action taken since last inspection	
(j)	Comments	

Inspector

Superintendent

Instructions for completing sheet 5, Exhibit D

Item (a)	Indicate name and location of structure and centerline station. This sheet is intended for use during inspections of the 3 control and diversion structures, the spillway, the Little Dry Creek Outlet Channel Wasteway and the gage recording stations.
Item (b)	Inspect the conduits and their intake and outlet structures for accumulations of sediment, rubbish and vegetal matter.
Item (c)	Record any settlement of the conduits or of the spillway and wasteway structures.
Item (d)	Indicate condition of concrete and record evidence of cracks, "pop-outs," spalls and abrasive wear. Note condition of expansive joints.
Item (e)	Note condition of riprap and indicate such change as disintegration of the rock, erosion or movement and the presence of vegetal growth through the riprap.
Item (f)	Note condition of control gates in respect to: freedom of movement in guides, condition of seals, condition of supports, lubrication, operating condition of hoist and gate position indicator. Indicate evidence of rust and condition of paint for gate and accessories.
Item (g)	Note condition of the access bridges, particularly the bolted connections and indicate the necessity for repainting.
Item (h)	Note condition of gaging facilities.
Item (i)	Indicate maintenance measures that have been performed since the last inspection.
Item (j)	Record opinion, if any, of contributory causes for conditions observed, and also any observations not covered under other columns.
NOTE:	One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's annual report.

CHECK LIST NO. 4
INSTRUMENTATION

Inspector's Report Sheet No. _____ Date _____

	Item	Remarks
(a)	Location of survey monuments	
(b)	Note any change in elevation	
(c)	Note any horizontal change	
(d)	Location and number of observation well	
(e)	Depth to water level (to tenth of foot)	
(f)	Condition of instrumentation	
(g)	Maintenance measures taken since last report	
(h)	Comments	

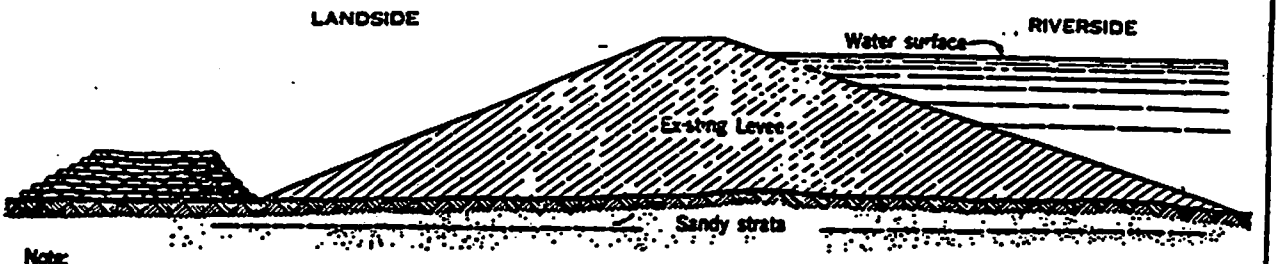
_____
Inspector

_____
Superintendent

Instructions for completing sheet 7, Exhibit D

Item (a)	Indicate the number and location of the survey monument by station.
Item (b)	Record the new elevation, the previous elevation and the resulting change, if any.
Item (c)	Record the new horizontal reading, the previous reading, and the difference, if any.
Item (d)	Indicate the number and location of the observation well by station.
Item (e)	Record new reading on depth to the water level to the nearest tenth of a foot, the previous reading, and the difference, if any. If relief wells are flowing, measure the flow individually and note clarity. If flow is visually turbid, collect samples.
Item (f)	For both the survey monuments, relief wells, and the observation wells, describe their overall condition and identify any repairs required. Inspect the concrete pads on the wells for rodent related erosion.
Item (g)	Indicate maintenance measures taken since the last report and the condition of the repair.
Item (h)	Record any other observations not covered above, as well as any opinions of causes of the conditions observed.
NOTE:	One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's report.

EXHIBIT E
DRAWINGS OF EMERGENCY LEVEE REPAIRS

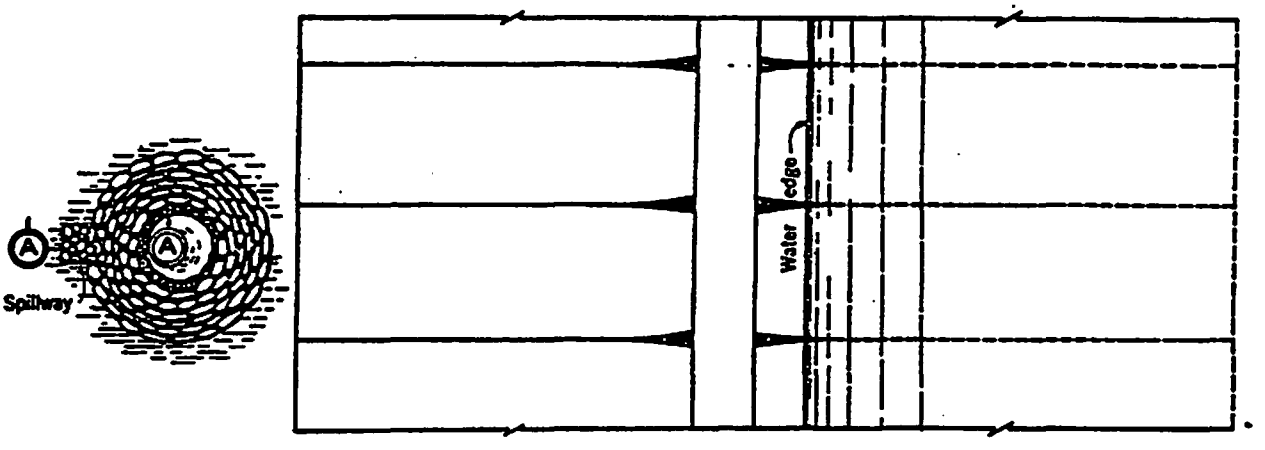


Note:

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

ELEVATION

SECTION A-A



PLAN

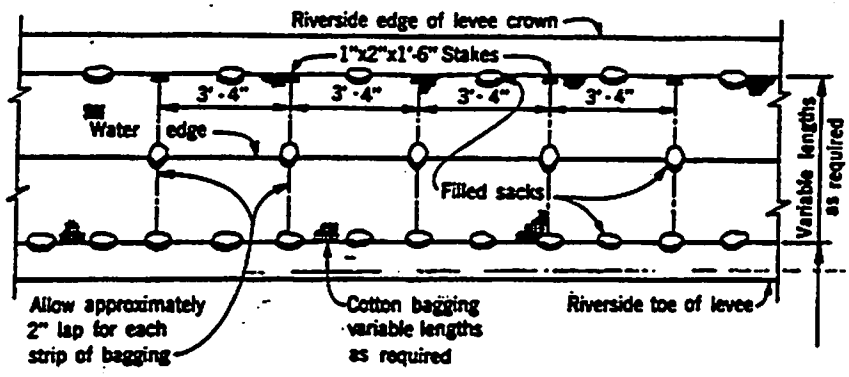
Note:

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

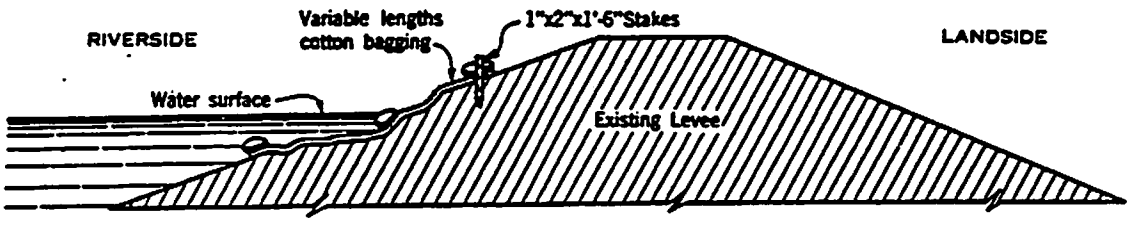
SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

CONTROL OF SAND BOILS

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



PLAN



SECTION

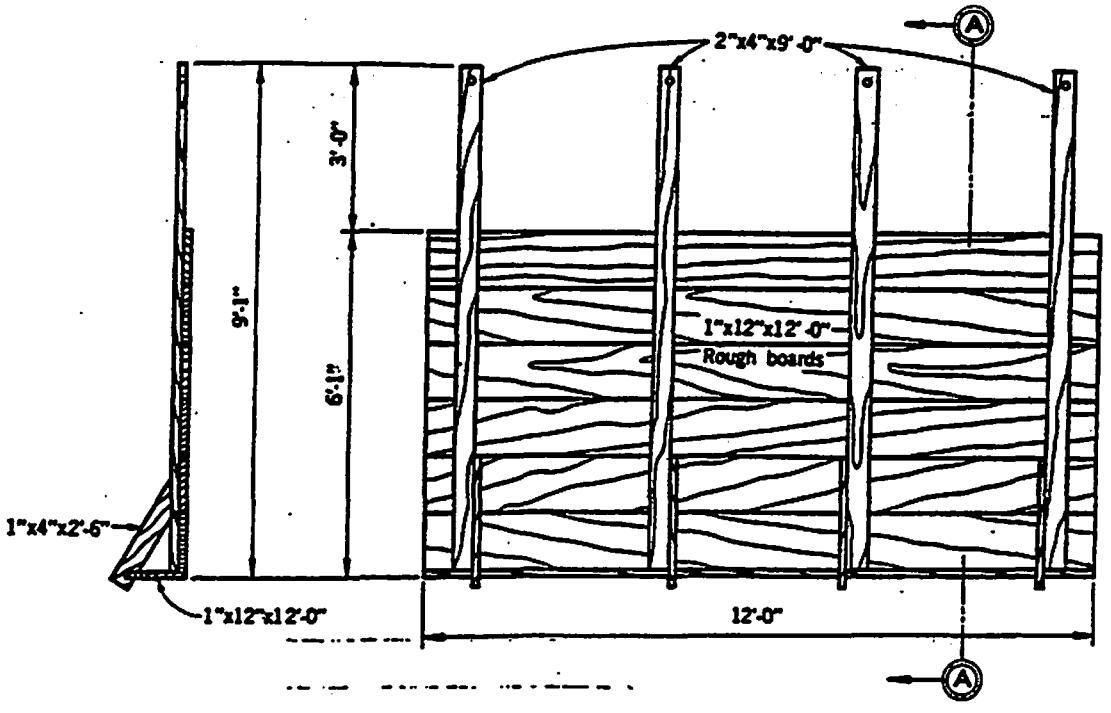
Note:
Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water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

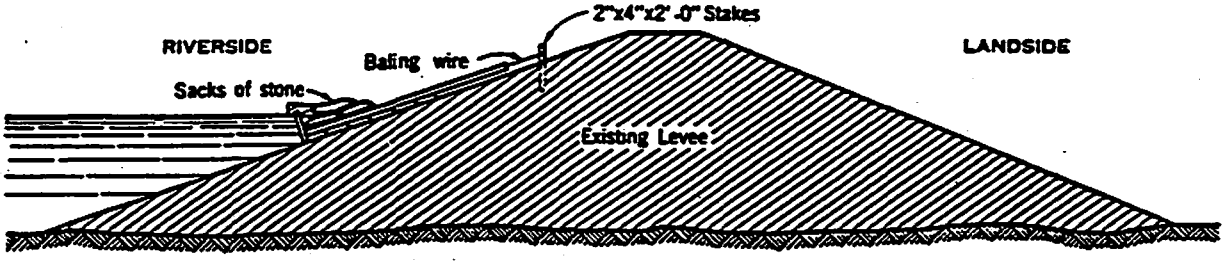
WAVE WASH PROTECTION

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



SECTION A-A

PLAN



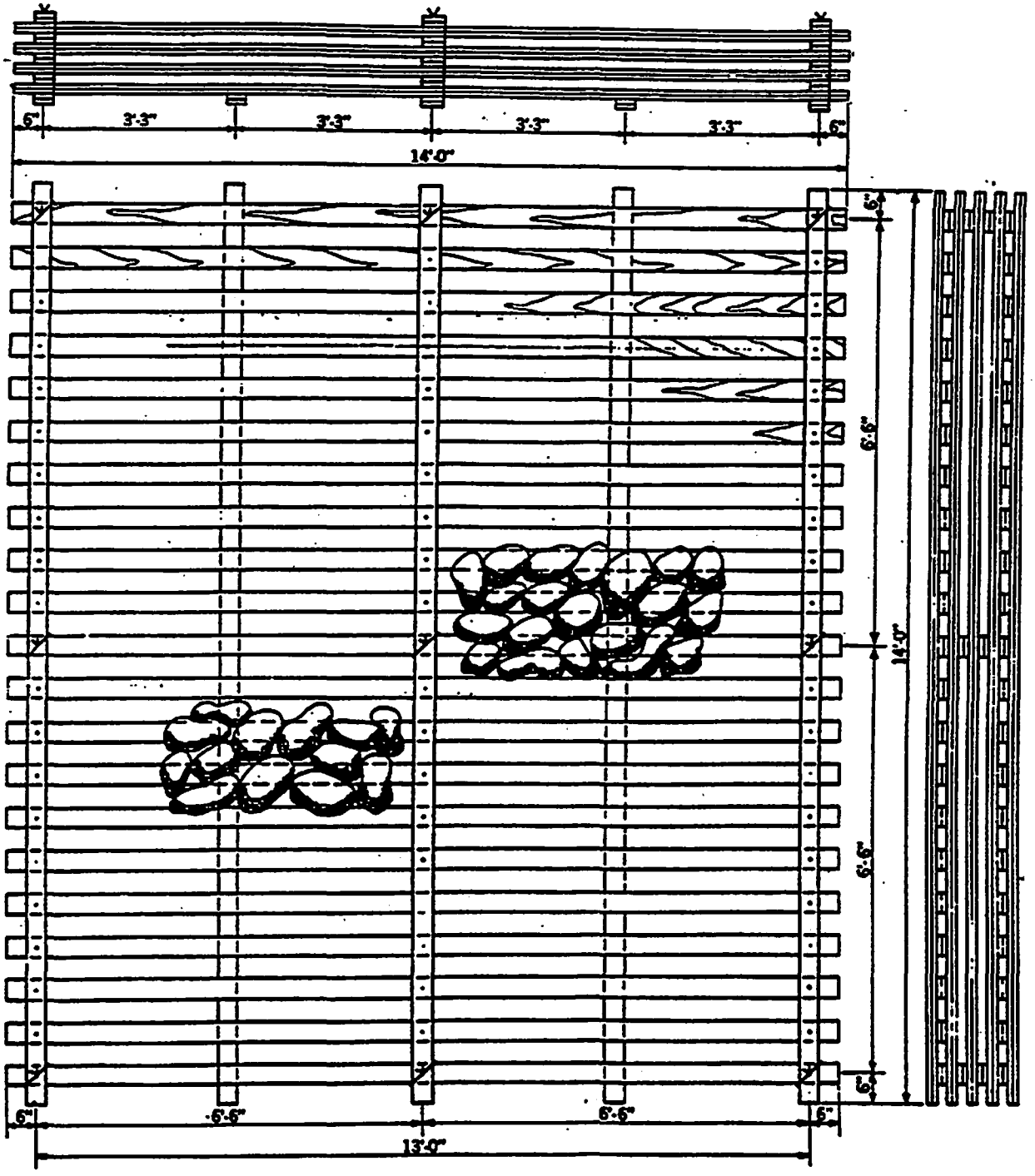
SECTION

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

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

MOVABLE 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
12½ lbs.-20d nails

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

CAVING BANK PROTECTION

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

Exhibit E Sheet 4 of 4

EXHIBIT F
MONITORING PLAN FOR ENVIRONMENTAL COMMITMENTS

MONITORING PLAN FOR ENVIRONMENTAL COMMITMENTS

EXHIBIT F

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EXHIBIT F

INTRODUCTION

The Merced County Streams, California, project was authorized by Section 201 of the Flood Control Act of December 31, 1970. Phase I of the project, the Castle Dam Unit, includes Castle Dam and Reservoir on Canal Creek and a check structure in the Main Canal. The environmental impacts for Phase I are discussed in the EIS completed by the U.S. Army Corps of Engineers (Corps) in 1980. In addition, the EA published by the Corps in 1992 describes the impacts associated with the construction and operation of the check structure on Main Canal. Mitigation for the project was incorporated into the contract specifications for the construction of the dam and into the maintenance manual. This monitoring plan represents one of our environmental commitments. A baseline survey of the vernal pools and the riparian mitigation area is contained in Attachment E.

This monitoring plan is to be implemented as part of the operation and maintenance of the Castle Dam Unit. The plan includes periodic evaluation of riparian mitigation measures and vernal pools. Section I of the monitoring plan addresses vernal pools, while Section II addresses riparian mitigation.

Section I: Vernal Pool Monitoring

Several vernal pools exist within the Castle Reservoir area and may be infrequently flooded. The location of these pools is shown on Attachment A. Monitoring will be required only after a flood event of sufficient magnitude inundates the existing vernal pools. The Corps estimates it would take a 300-year event to flood these pools. The existing vernal pools are located between elevations 200 and 210 feet mean sea level.

The objectives of vernal pool monitoring are:

- to adequately describe pre-inundation and post-inundation conditions at the pools within the Castle Reservoir site

- to collect and assess data by standard methods and format that allow for comparison with past/future monitoring studies

- to describe any biological change in the vernal pools related to flooding caused by the pooling of water behind Castle Dam

49

Previous Surveys

Coordination with the U.S. Fish and Wildlife Service in 1988 indicated that several Federal candidate and proposed threatened and endangered plant and invertebrate taxa might be found in the area. As a result, a series of five field surveys were conducted by Roy Woodward (1988-92) to locate potential sensitive plant species and habitats in the Castle Reservoir area. During the last two years (1991 and 1992), invertebrates were also targeted in the surveys. No rare plant or invertebrate species were discovered in the reservoir area during any of the surveys. However, during the 1992 survey of some vernal pools outside the reservoir zone, Woodward found vernal pool fairy shrimp (*Branchinecta lynchi*) and California linderiella (*Linderiella occidentalis*). The vernal pool fairy shrimp is a Federally listed species.

Role of Local Sponsor

Qualified personnel will conduct the sampling and assessment of vernal pools in Castle Reservoir. Qualified personnel need to be experienced with the survey of vernal pools. They must be familiar with monitoring procedures, identification of vernal pool plant species, invertebrate species. The surveys and subsequent analysis are designed to reveal any biological change resulting from this inundation. The surveys will focus on plant and invertebrate resources. Attachment B provides a general list of vernal pool species.

The local sponsor will be required to survey the vernal pools the year following the inundation as a result of project operation. This will be determined by reviewing the reservoir elevations at the end of the flood season. The vernal pools are located between elevations 200 and 210 feet in elevation. At the end of the flood season, the local sponsor will note, in the annual maintenance report, the number of times the reservoir inundated the vernal pools (if any) and the steps taken to secure qualified personnel for the survey. If the vernal pools are inundated, the monitoring requirement is triggered and will take place the following spring as described below.

SAMPLING METHODOLOGY

At a minimum, monitoring will target at least four plant species that best represent these pools. The survey should include a determination of plant species composition and a cover estimate by plant species, vegetative litter, bare soil, rock, and animal disturbance, if any. Any standard quantitative assessment method which provides a statistical comparison of results is acceptable. Each pool should be surveyed twice during each sampling year, once between February 1 and April 1, and a second time between April 2 and June 15 (there should be a minimum of at least two weeks between sampling periods). Also, the

dimensions of each pool, as defined by vegetation (average width and length, not depth), will be measured and approximate scale sketches made on Project vernal pool maps (Attachment A).

The sponsor should inform appropriate landowners at least three days in advance of any field visits and obtain approval for access.

REPORTING

A final report containing the following sections shall be submitted to the Corps, and other agencies if requested, by August 30 of any monitoring year.

Section I - Executive summary giving objectives of the monitoring program, a brief summary of the results, and any proposed remediation measures.

Section II - Vegetation Chapter:

1) Detailed description of sampling method including justification for use of the method.

2) Explanation of methods used for taxonomic descriptions of plants. The location of any voucher specimens should be noted. Note: California threatened or endangered plant species should not be collected without prior approval of the California Department of Fish and Game (CDFG). If any special status plant species, including state listed species, are discovered their identification must be verified by collections or detailed photographs.

3) Photographs showing representative vernal pools and characteristic plant species.

4) Compilation of vegetation data including tables showing plant species composition by pool, and simple summations (totals, means, standard deviations) of plant cover values by pool.

5) Maps with sketch drawings of pools and approximate dimensions as measured in the field.

6) Data Analysis and discussion of results and findings. A statistical comparison of results from post-project vernal pools with pre-project vernal pools should be made. Include recommendations for possible remediation to specific pools, if any. Include a discussion of the monitoring procedure and techniques which might be modified for future annual monitoring efforts.

7) Legible copies of original data sheets. These data sheets should contain the date of the survey, names of the surveyors, number/names of pools, brief description of pool location, measured dimensions of pools, and vegetation data. Notes on the data sheet should also mention the hydrologic condition of the pool and any signs of disturbance from livestock or humans.

8) Copies of any Natural Diversity Data Base forms submitted to CDFG.

9) Copies of significant vernal pool literature compiled for this effort.

Section II: Riparian Mitigation Monitoring

The Corps and the local sponsor committed to a number of mitigation measures for riparian habitat. They are briefly described below. A more detailed description of these commitments can be found in the September 1992 Final Environmental Assessment for check structure of the Castle Dam Unit. These environmental commitments are complete.

A. Live vegetation along Canal Creek will be left as is except for those areas to be used for borrow and construction. Dead, fallen trees and other debris in the storage pool that present a safety hazard to the dam will be removed.

B. Grade borrow areas to create two swales low enough so that riparian will reestablish.

C. Enhance 18 acres of land within the reservoir pool between elevation 192.5 and 205 feet. An additional 22 acres have been acquired for mitigation land bringing the total to 40 acres. This area has been fenced to preclude livestock grazing and will be allowed to revegetate naturally.

D. Topsoil will be stockpiled during construction and later applied to the mitigation (graded borrow area), and other disturbed areas.

E. Disturbed areas will be reseeded with native grasses recommended by the FWS. Disturbed areas were seeded, but not with a native mixture.

F. Brush piles to provide cover for upland species will be created on the mitigation lands just outside the storage pool. Attachment C shows the location of these brush piles.

MONITORING AND REPORTING

The local sponsor shall submit an annual monitoring report for the wildlife mitigation area. The report shall be submitted with the Superintendents annual report to the District Engineer, not later than October 1 of each year. At a minimum this will include the following items. A sample checklist is shown in Attachment D.

A) Annual inspection of the fence and fenced area at the end of the rainy season. If there are areas that need repair, this will be noted and the repairs made.

B) Describe condition of the brush piles.

C) Within the fenced mitigation area (approximately 80 acres as shown on Attachment C), describe condition of riparian revegetation. Note whether or not riparian is colonizing the area. Note any disturbances - human, livestock, or other animals. If area does not appear to be revegetating with riparian, make recommendations for remediation measures. Provide a schematic drawing noting the location of any new riparian.

D) Provide a qualitative description of the existing riparian within the reservoir. This should describe the health and vigor of the existing stand and describe whether any recruitment of new growth is taking place.

E) Provide photographic documentation of both the existing riparian and the newly established riparian within the mitigation area.

F) Note any wildlife or bird use of the area, or any other changes that demonstrate the success of the site.

G) Provide a description of any vegetation removed, including its location and reasons for its removal.

H) Describe any effects of flooding on mitigation area. Describe any damage to vegetation as a result of flood operations. If there are any changes to wetlands or riparian vegetation due to something other than flood flows, document these changes along with the causes for the changes.

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_____. 1992. Merced County Streams Project - Threatened and Endangered Species Survey 1992. Report to U.S. Army Corps of Engineers, Sacramento District.

VERNAL POOL MAP

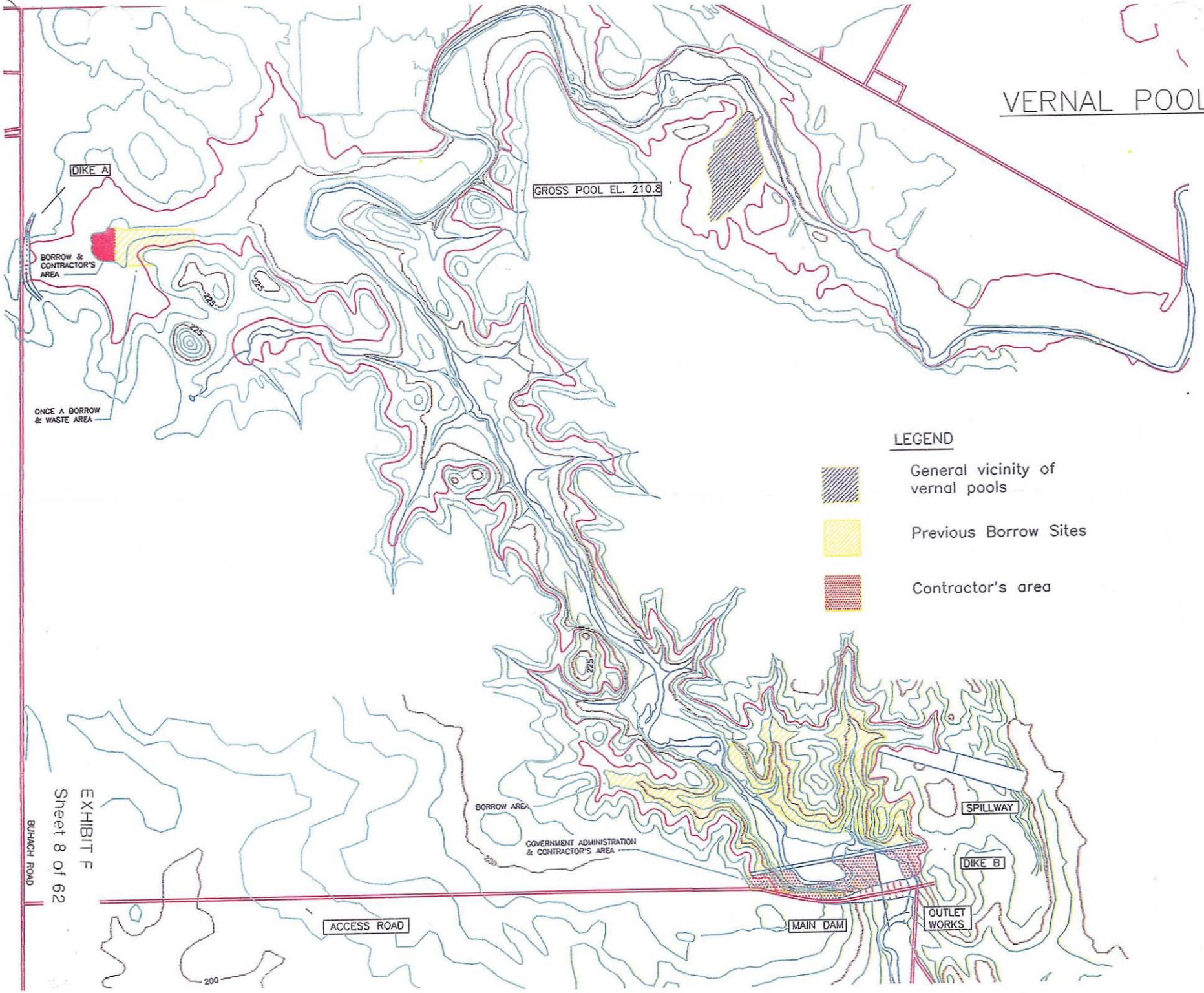

EXHIBIT F
Sheet 8 of 62

ATTACHMENT B

VERNAL POOL PLANT GENERA

Plant Genera (natives), which are either vernal pool obligates or, at least when found in the Central Valley, more frequently occur in vernal pools than other habitats.

Agrostis hendersonii
Alopecurus sacsatus
Bergia texana
Blennosperma nanum
Briza minor
Epilobium cleistogamum
Castilleja campestris
Dichelostemma capitatum ssp. *capitatum*
Callitriche marginata
Centunculus minimus
Cicendia quadrangularis
Cuscuta howelliana
Deschampsia danthonioides
Downinga bella
D. bicornuta
D. cuspidata
D. ornatissima
D. pusilla
Eleocharis acicularis
Eryngium pinnatiscetum
E. spinosepalum
E. vaseyi
Gratiola embracteata
G. heterosepela
Isoetes howellii
I. orcuttii
Juncus unicalis
J. leiospermus var. *leiospermus*
J. leiospermus var. *ahartii*
Lasthenia chrysantha
L. conjugens
L. fremontii
L. glaberrima
L. glabrata
Layia fremontii
Legenere limosa
Lilaea scilloides
Limnanthes alba
L. douglasii
L. flocossa ssp. *californica*
Mimulus tricolor
Montia fontana
Myosurus minimus
Naverretia leucocephala
N. intertexta ssp. *intertexta*
N. myersii
N. nigelliformis
N. tagetina
Neostapfia colusana
Orcuttia tenuis
O. viscida
Pilularia americana
Plagiobothrys austinae
P. acanthocarpus
P. bracteatus
P. greenei
P. humistratus
P. hystriculus
P. leptocladus
P. stipitatus
P. undulatus
Pogogyne zizyphoroides
Psilocarphus brevissimus
P. oregonus
P. trenellus var. *globiferus*
Ranunculus bonariensis var. *trisepalus*
Sagina decumbens ssp. *occidentalis*
Tuctoria greenei
Tuctoria mucronata

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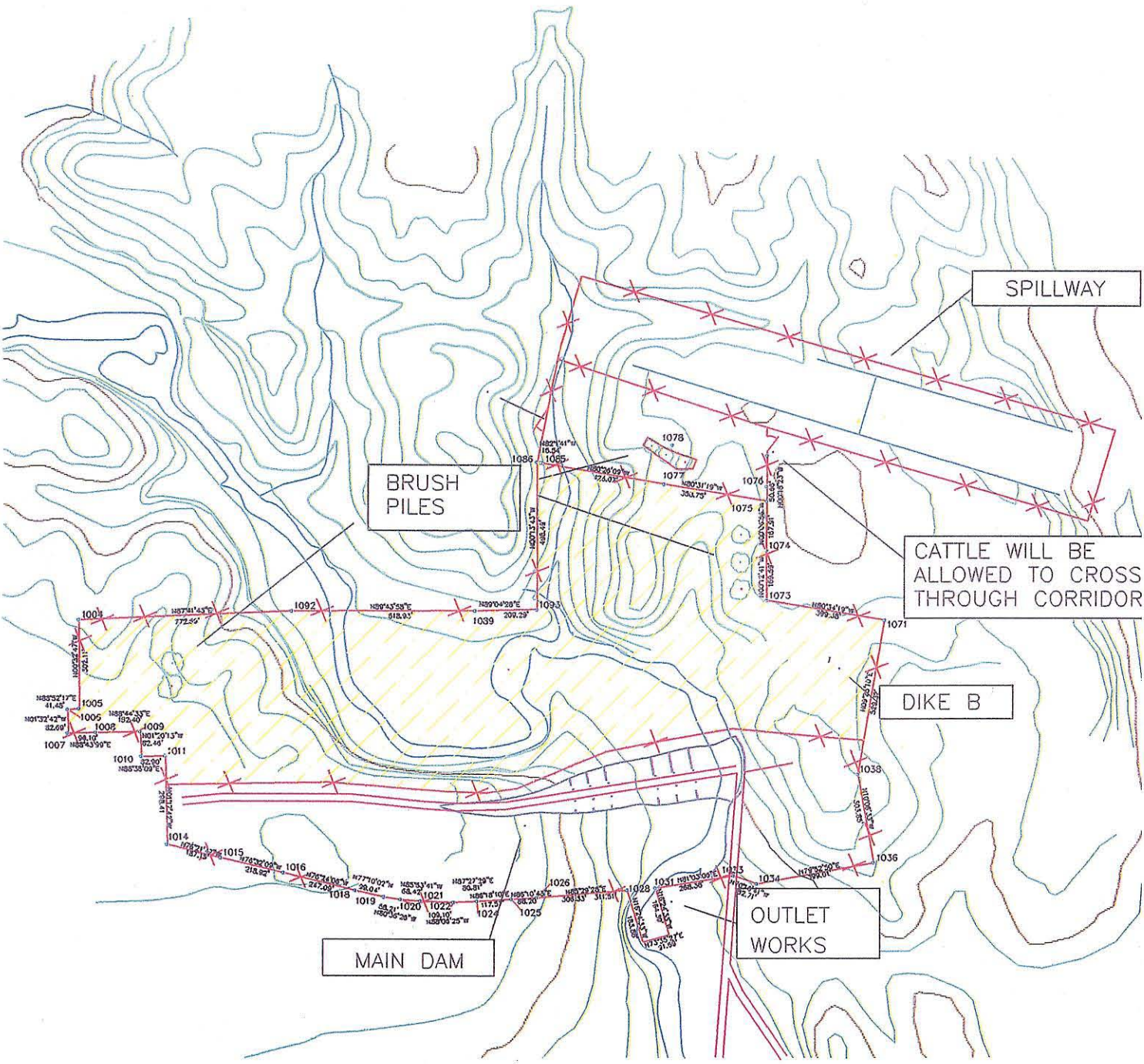
ATTACHMENT C

LOCATION OF BRUSH PILES AND FENCED MITIGATION AREAS



1" = 500'

ATTACHMENT D
SAMPLE CHECKLIST FOR RIPARIAN MONITORING

Inspector's Report Sheet No._____ Date_____

	Item	Remarks
(a)	Disturbance of the mitigation area	
(b)	Condition of fences	
(c)	Removal of any vegetation	
(d)	Condition of mitigation areas	
(e)	Condition of brush piles	
(f)	Affects of flood operations	
(g)	Changes in wetlands, vegetation	
(h)	Success of program	
(i)	New environmental measures taken	
(j)	Maintenance measures taken	
(k)	Comments	

_____
Inspector

_____
Superintendent

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Attachment D
Instructions for completing checklist

(a) Provide a description of any disturbance to the mitigation areas. This should include an explanation of the circumstances around the disturbance, an assessment of the damage, description of repairs made, and information on any prosecutions resulting from the disturbance.

(b) A statement describing the physical condition of the fences and gates around the mitigation area and any repairs that were made.

(c) A description of any vegetation removed from the project site or reservoir area, including its location and method of removal. This statement should also describe the reasons for its removal.

(d) A description of the vegetation that is being reestablished in the mitigation areas. This description should include photographs to help document the condition of the mitigation areas.

(e) A statement describing the conditions of the brush piles. Describe any damage.

(f) A description of the effects of any flood operations during the previous flood season on the mitigation area.

(g) A description of any damage to vegetation along Canal, Edendale, and Fahrens Creeks due to flood operations during the previous flood season. If there are any changes in wetlands and riparian vegetation from something other than flood flows, document these changes along with the apparent cause.

(h) A description of any experiences since the last report that demonstrate the success of the mitigation program, such as wildlife or bird use in the area.

(i) A description of any new actions implemented that would enhance the mitigation area.

(j) Indicate maintenance measures that have been taken since the last report and their condition.

(k) Record opinion, if any, of contributory causes of conditions observed, along with any observations not covered in checklist.

Baseline Survey for Environmental Commitments at Castle Reservoir, Merced County Streams Project

ATTACHMENT E

July 1995

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and

Carol W. Witham
(916) 753-5872

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Executive Summary

A baseline survey of biological conditions at vernal pools and the riparian area of the Castle Dam Reservoir was conducted in spring 1995. The survey found that vernal pools are in good condition and quantitative data was gathered which can be used in future statistical comparisons. No listed threatened or endangered plant or aquatic invertebrate species were discovered in the vernal pools. Some large trees in the riparian forest have died because of flooding, but willow seedlings are establishing in some spots. The brush piles have created wildlife habitat and all fences and revegetation are functioning as intended. Wildlife are utilizing the Reservoir area and a great blue heron/great egret rookery, a wildlife habitat element of special concern, was discovered.

I. Introduction

Phase 1 of the Merced County Streams Project includes Castle Dam and Reservoir on Canal Creek and a check structure in the Main Canal. Castle Dam became operational in 1993 and consists of an earthen dam which creates a temporary reservoir. In years with high water flow the Reservoir may inundate sensitive vernal pool habitats which have been identified near Canal Creek. Environmental mitigation for other Reservoir impacts which was applied at the Dam site consisted of grading and contouring 18 acres of land immediately behind the dam to allow riparian vegetation colonization; construction of brush piles for wildlife cover; revegetation of disturbed areas and fencing to exclude cattle. Monitoring is to address both the vernal pools and the riparian mitigation area.

Environmental monitoring for the Castle Dam Unit of the Merced County Streams Project requires, (1) vernal pool surveys and analysis following inundation from reservoir operations, and, (2) annual surveys and analysis of the riparian mitigation areas. Towards this end Contract Order Number DACW05-95-P-0795 was issued and field baseline

surveys were conducted in spring 1995. See attached Scope of Work for additional details of survey objectives.

II. Methods

Vernal Pools

Vernal pool surveys were conducted twice during the spring of 1995: (1) March 6 when pools contained standing water, aquatic invertebrates were likely to be present, and plants were in early growth stages, and (2) April 23 when most pools were dry and late season plant species were evident. Representative photographs were taken of the vernal pool area. Dimensions of each vernal pool were measured with a tape measure and a sketch map (approximately to scale) was created.

Vegetation:

Vegetation surveys consisted of identifying and estimating the percentage cover for all plant species present in each vernal pool by slowly walking and examining the pool surface during each site visit. The percent cover of bare soil, rocks, cobbles, standing water, bryophytes and lichens, and animal droppings (cows, etc.) were also recorded. This method of quantifying vegetation cover is called the releve or Braun-Blanquet method. No voucher specimens were collected. Plant names follow The Jepson Manual, Higher Plants of California, James C. Hickman, editor, University of California Press, Berkeley, 1993, 1,400 p.

Invertebrates:

During the March 6 site visit each pool had standing water which was generally clear. Pools were visually inspected from the margin and all swimming invertebrates were

noted. Fairy shrimp were identified according to the past experience of the surveyors based upon the morphology and behavior of each animal observed; no voucher specimens were collected.

Riparian Areas

The riparian areas in and upstream of the Reservoir were inspected on June 25, 1995. No quantitative data was collected but the general overall condition of the area was qualitatively assessed. Representative photographs were taken of the Reservoir and riparian areas.

Brush Piles

Ten brush piles were constructed to provide wildlife cover. Each pile was visually inspected and the general condition of each pile and all signs of wildlife use were noted.

Condition of Fences

All fences in the vicinity of the dam and brush piles were visually inspected to assess general condition and effectiveness at excluding livestock.

Riparian Vegetation

The entire reservoir area upstream to the vicinity of the vernal pools was inspected by walking survey. The condition of riparian vegetation was noted and any extraordinary findings were recorded.

Wildlife

All wildlife sightings and sign (tracks, scat, bones, etc.) which were observed during any of the field visits were recorded.

III. Results

The findings of field surveys are presented to provide baseline information and no statistical comparisons have been made with previous data from this area or other vernal pool or riparian data from California. It will be possible to compare future monitoring data with this baseline data to assess if conditions in the area have changed.

Wildlife

Table 1 contains a list of wildlife species or sign observed during the three field visits; the list includes sightings throughout the Castle Dam Reservoir, and vernal pool areas. The total number of wildlife species in the vicinity of the project is expected to be much greater than those reported here.

The most notable finding of the wildlife survey was the presence of a great blue heron/great egret rookery in the Reservoir area just upstream from the Castle Dam (see Figure 3 for the approximate location of the tree). There were at least 6 nests in a large cottonwood tree?, two of which contained young great blue herons. Great blue heron and great egret rookeries are a wildlife habitat element of special concern in California and are tracked by the California Department of Fish and Game Natural Diversity Data Base.

Vernal Pools

Figure 1 shows the general location of the vernal pools in the Castle Dam Reservoir area. A sketch map of the vernal pools is included as Figure 2 and Figure 4 shows the location of the vernal pool complex in relation to site topography. The vernal pools consist as a

loose chain of pools and swales for which quantitative data was collected for the seven main pools (designated A, B, C, D, E, F, G). The winter of 1994-95 was an exceptionally wet year and the pools were in excellent condition during this year's surveys. Photographs of the vernal pools are attached.

Vegetation

Table 2 presents the list of plant species discovered in each vernal pool. Summary statistics are also reported and two indices of the prevalence of each species were computed (Importance Value 1 = average cover multiplied by the frequency of occurrence; and Importance Value 2 = summation of cover of each plant species in all seven vernal pools). The top nine species in the table have Importance Values greater than the average (mean) for the group.

Tables 3 through 9 present vegetation data for individual pools. Richness (total number of species) and diversity (an indicator of how much each pool differs from the other pools in the group) is also shown. The richness of vernal pool endemic species (native plant species which only occur in vernal pools), other California native species, and non-native invasive species are shown separately because these may be important indicators of vernal pool condition. Table 10 contains a summary of species richness and diversity which will be useful for future statistical comparisons.

In general these vernal pools are in good condition. The pools have a somewhat different species composition and less diversity than other vernal pools in the area, such as those on the Flying M Ranch. This is a result of the relatively young age of the Crane Ranch pools being on the flood plain of Canal Creek. Also, plant taxa typical of vernal pools on the floor of the San Joaquin Valley often have a high component of alkaline tolerant species which are lacking in the Crane Ranch pools because of their more neutral soils. Future monitoring of these pools, if required, should assess (presence/absence and cover estimates) all species present in this pool complex to determine changes in diversity. The

only likely impact to these pools from project operation would be an increase in the number of exotic wetland species; however, subtle changes such as permanent loss of existing vernal pool species could also be an indicator of modifications to the pools. Compiling a complete species list of vernal pool plants is a relatively swift process for qualified botanists while they are performing the monitoring surveys.

Invertebrates

Table 11 contains a summary of groups of aquatic invertebrates which were discovered in each pool. No listed threatened or endangered species were observed in any of the pools, though *Linderiella occidentalis*, a fairy shrimp which was considered for federal listed but remanded, was observed in two pools (C and D). Two of the pools, F and G, are very shallow and no aquatic invertebrates were observed.

In general, aquatic invertebrate density in this vernal pool cluster appeared low as only occasional individuals were observed. The pools are annually disturbed by cattle which affect water quality and trample eggs and reduce cover of vegetation. Rare fairy shrimp have been found nearby in vernal pools on different soil types, but they have never been found in the vernal pools on the younger soils along the banks of Canal Creek.

Riparian Areas

Figure 3 is a sketch map (not to scale) of the riparian vegetation and other notable features in the Castle Dam Reservoir. The open areas between the vegetated clumps contained standing water during all of the field visits. Representative photographs of the Reservoir area are attached.

Brush Piles

The ten brush piles are in good condition and there is evidence of bird and small mammal use at each pile. It also appears that some larger mammals, possible gray fox, coyote, skunk, etc. have utilized the piles for cover or burrows. The piles are a considerable distance from the Reservoir water's edge which limits their use by riparian species. In general, the brush piles appear to be in good condition and have been successful in providing wildlife habitat.

Condition of Fences

All of the fences in the vicinity of the Castle Dam and Reservoir are in good condition and adequately exclude livestock.

Riparian Vegetation

All borrow areas in the vicinity of the Castle Dam have revegetated, mostly with annual grasses and exotic clover species. There is no active erosion problem in the Reservoir area.

The riparian vegetation in the 80 acre mitigation area consists mostly of small willows (*Salix gooddingii*) with a few small clumps of bulrush (*Scirpus acutus*). All of the larger trees, especially cottonwoods (*Populus fremontii*) have died or are dying as a result of continual inundation. Young willows have begun to establish along the new banks of the Reservoir in a few spots but most areas are dominated by annual grasses and exotic forbs. Flood flows are not permanently contained behind Castle Dam because it is a dry dam. However, in addition to flood flows, Castle Dam is used to pass irrigation flows. As a result, the water level behind the dam fluctuates. The irrigation pool is limited to approximately elevation 193. During the June 25, 1995 site visit the water level of the reservoir was increasing from irrigation flows.

The pool of the Reservoir reaches upstream over two miles and most of the existing riparian trees are receiving an increased amount and prolonged period of inundation. As noted above, the relatively few cottonwoods in this area do not appear to be persisting under the increased flooding and there are few suitable open sand bars in the Reservoir area which this species prefers for seedling establishment. It is possible that cottonwoods will be eliminated from the Reservoir area because of flooding. Most of the large willows in the upstream reaches appeared healthy. There has not been any establishment of young willows upstream of the 80 acre mitigation area.

IV. Conclusions

The baseline survey of the vernal pools and riparian vegetation was successful in establishing existing conditions and gathering data which will be useful for future statistical comparisons, if necessary. The survey techniques were rapid and efficient and in general should not be modified except that in years with less rainfall (or unusual rainfall patterns) the field surveys should be conducted earlier in the season to get a true perspective of plant and aquatic invertebrate presence and abundance.

The vernal pools are in good condition given the amount of livestock impacts they receive. The riparian forest has been affected by the project, but it is too early to determine if natural tree establishment will replace individuals which are dead or dying. The brush piles have created wildlife habitat and all fences and revegetation are functioning as intended. Wildlife utilize the Castle Dam Reservoir area and a great blue heron/great egret rookery, a wildlife habitat element of special concern, is functioning inside the Reservoir.

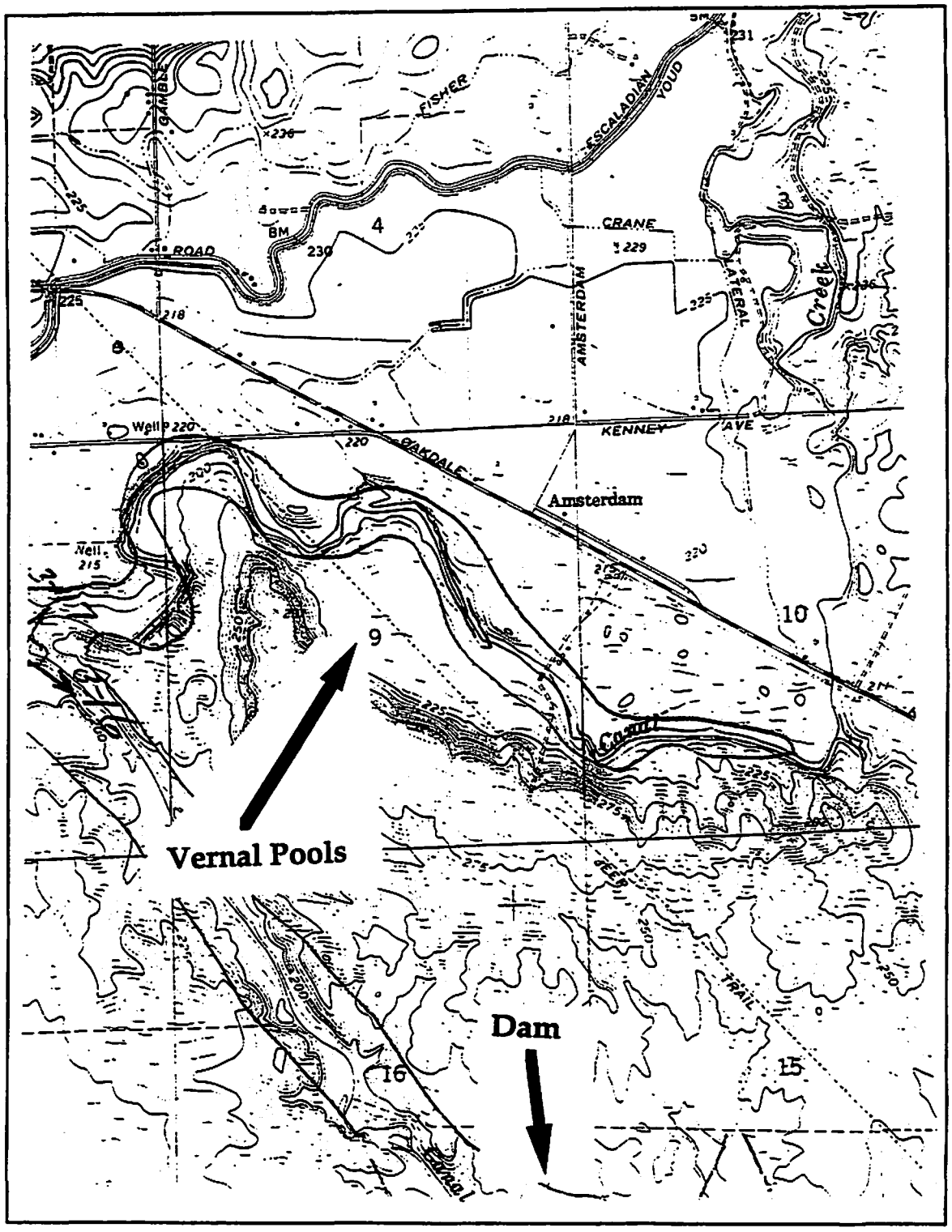


Figure 1: Vernal pool complex at Crane Ranch near Castle Dam (Winton 7.5′ USGS quad).

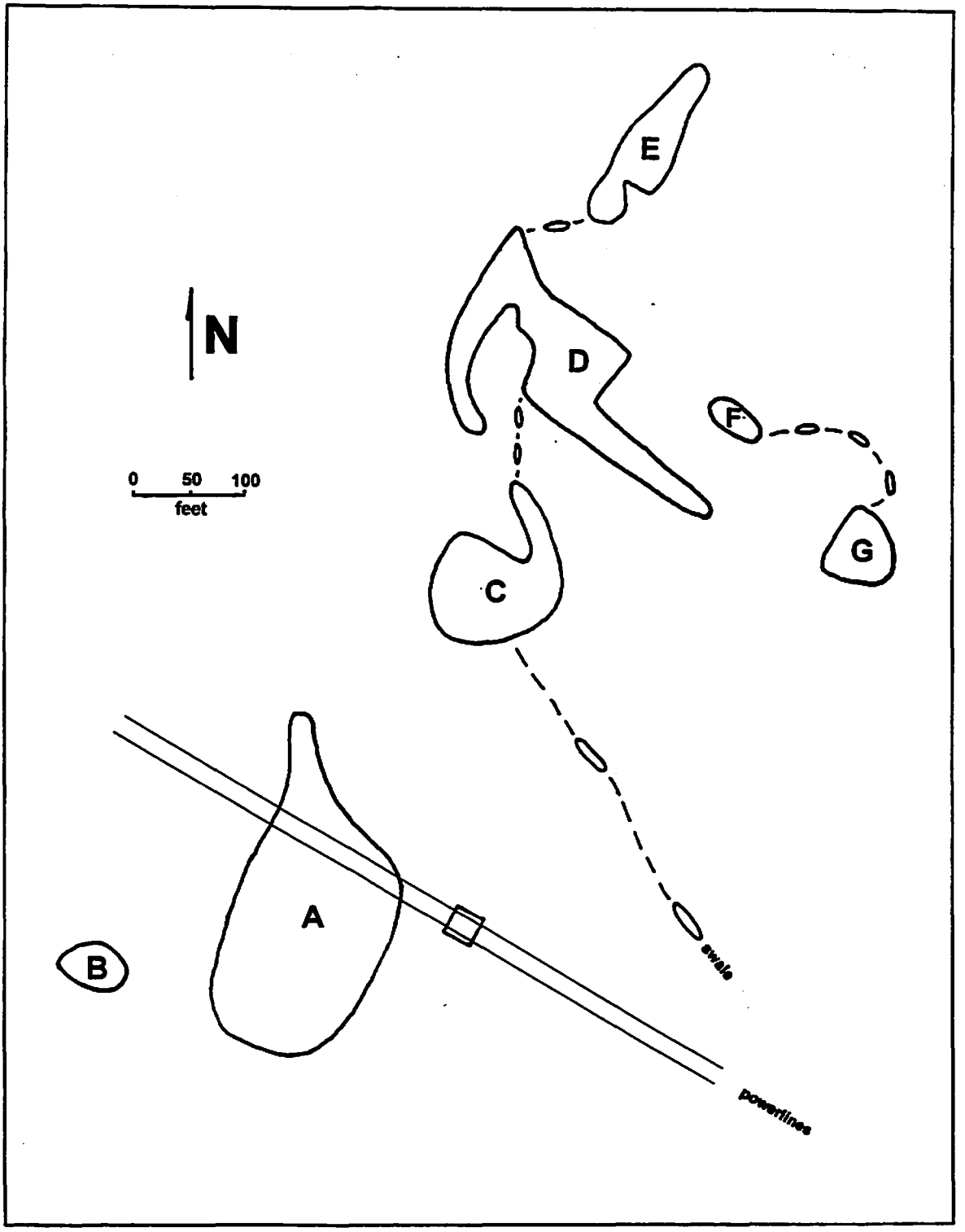


Figure 2: Sketch map depicting relative size and location of vernal pools. Each pool is designated by a unique letter which is linked to vegetation data, invertebrate survey data and physical dimensions.

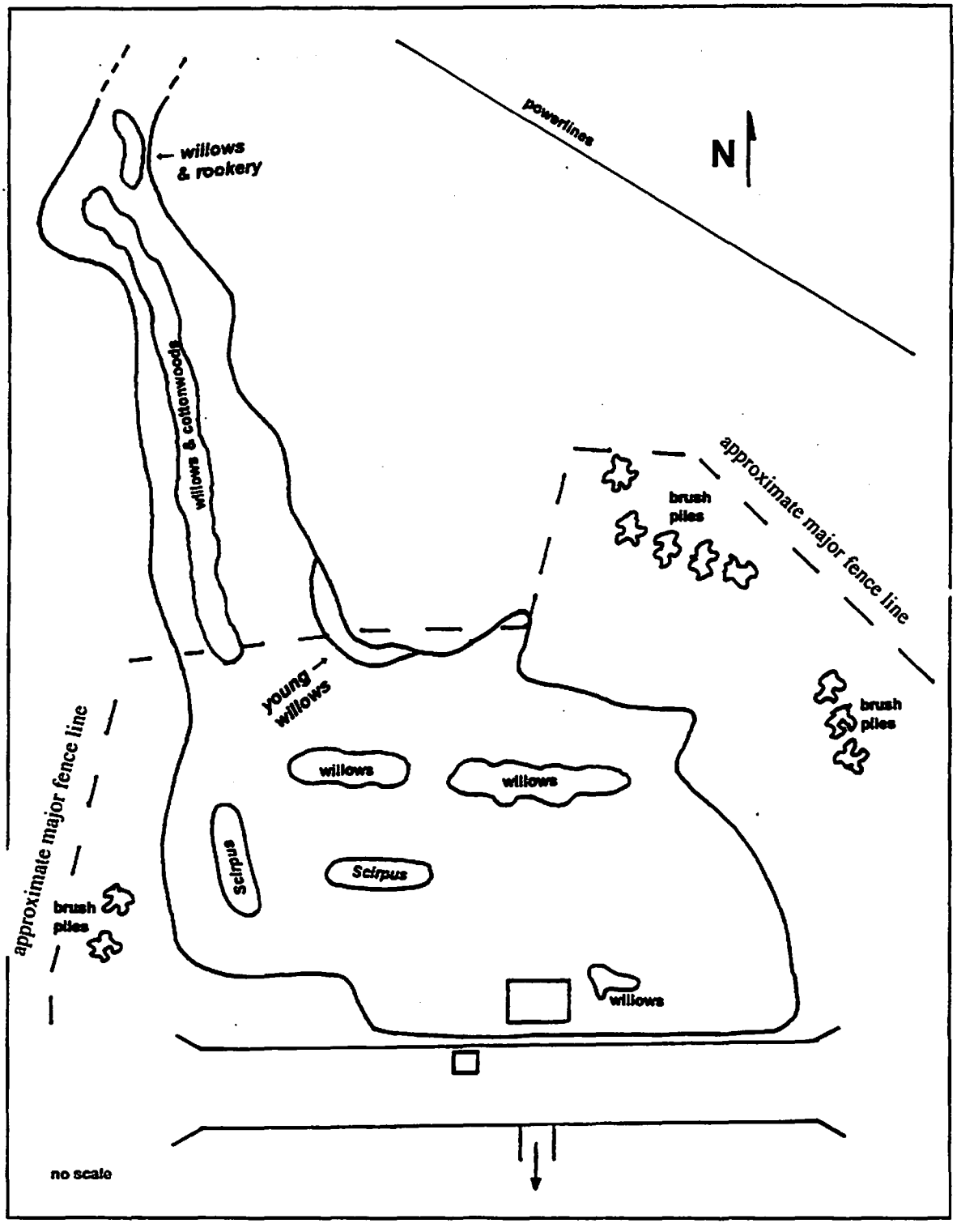
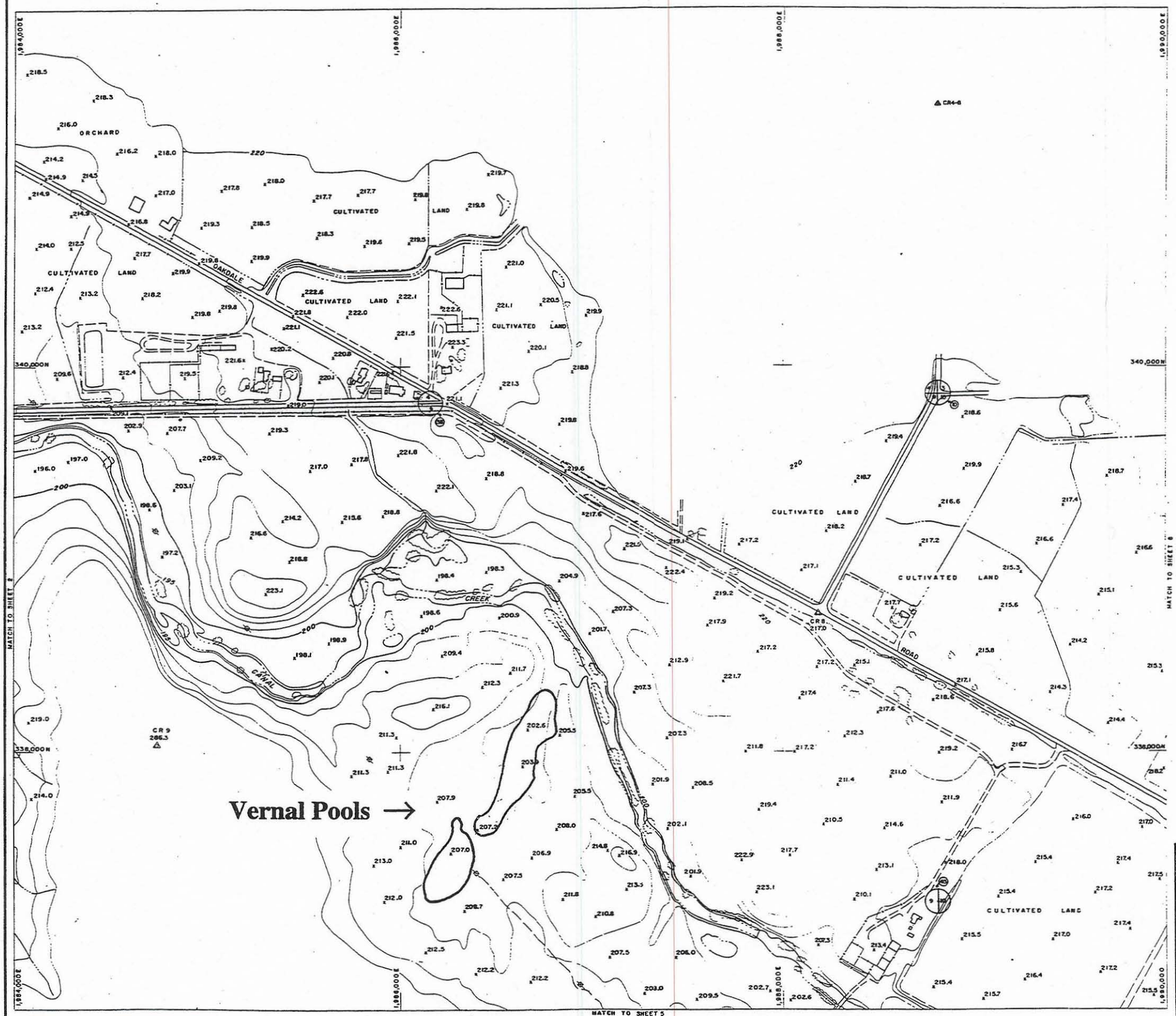


Figure 3: Sketch map depicting storage pool area and pertinent physical and vegetation features. Note area of willow recruitment just left of center sketch and Great Blue Heron/Great Egret rookery in upper left.

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-76

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

Figure 4. Vernal pool complex in relation to site topography.

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FILE NO.

SHEETS SHEET NO.

SAFETY PAYS

Table 1: Wildlife observed during field visits conducted on March 6, April 23 and June 25, 1995. Asterisk (*) indicated presence inferred from indirect observations.

Birds

- Pied-billed Grebe
- Double-crested Cormorant
- Great Blue Heron
- Great Egret
- Green-winged Teal
- Mallard
- Northern Shoveler
- Turkey Vulture
- Black-shouldered Kite
- Red-tailed Hawk
- American Kestrel
- American Coot
- Killdeer
- Black-necked Stilt
- Greater Yellowlegs
- Mourning Dove
- Great Horned Owl
- Black Phoebe
- Western Kingbird
- Horned Lark
- Violet-green Swallow
- Cliff Swallow
- Scrub Jay
- Loggerhead Shrike
- White-crowned Sparrow
- Red-winged Blackbird
- Tricolored Blackbird
- Western Meadowlark
- Brewer's Blackbird
- House Finch

Mammals

- Black-tailed Hare
- Beaver
- Coyote*
- Raccoon*
- Striped Skunk*
- small burrowing animals*

Reptiles and Amphibians

- Pacific Treefrog
- Bullfrog
- Western Fence (blue-bellied) Lizard

Fish

- Bass (largemouth)*
- Carp*

Table 2: Vernal Pool Species of Importance
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Maximum Absolute % Cover Pool A	Maximum Absolute % Cover Pool B	Maximum Absolute % Cover Pool C	Maximum Absolute % Cover Pool D	Maximum Absolute % Cover Pool E	Maximum Absolute % Cover Pool F	Maximum Absolute % Cover Pool G	Average Absolute % Cover	Frequency Found	Importance Value 1 (Avg Cover x Frequency)	Importance Value 2 (Cover Sum all Pools)
Eryngium vaseyi+	Apiaceae	12.0	30.0	25.0	12.0	30.0	35.0	45.0	27.00	1.00	27.00	189.0
Plagiobothrys stipitatus var. micranthus+	Boraginaceae	12.0	7.0	10.0	7.0	10.0	1.0	8.0	7.86	1.00	7.86	55.0
Crassula aquatica	Crassulaceae	1.0	4.0	3.0	20.0	15.0	5.0	5.0	7.57	1.00	7.57	53.0
Epilobium densiflorum	Onagraceae	15.0	20.0	8.0	4.0	2.0		2.0	7.29	0.86	6.24	51.0
Psilocarphus brevissimus var. brevissimus+	Asteraceae	2.0		3.0	3.0	10.0	0.1	3.0	3.01	0.86	2.58	21.1
Hordeum marinum ssp. gussoneanum*	Poaceae	3.0	3.0	1.0	1.0	2.0	3.0	2.0	2.14	1.00	2.14	15.0
Lythrum hyssopifolia*	Lythracaceae	0.4	1.0	4.0	4.0	0.5	1.0	2.0	1.84	1.00	1.84	12.9
Pilularia americana+	Marsileaceae	0.7	0.3	0.5	1.0	2.0	1.0	5.0	1.50	1.00	1.50	10.5
Hemizonia fitchii	Asteraceae	0.2	0.8	2.0	2.0	0.3	2.0	2.0	1.33	1.00	1.33	9.3
Plagiobothrys greenei+	Boraginaceae	1.0	1.0	0.5	1.0	1.0	2.0	1.0	1.07	1.00	1.07	7.5
Downingia ornatissima var. ornatissima+	Campanulaceae	1.0	0.1	1.0	3.0	1.0	0.1	1.0	1.03	1.00	1.03	7.2
Callitriche marginata+	Callitrichaceae	0.2	2.0	0.5	0.3	0.5	3.0	0.5	1.00	1.00	1.00	7.0
Juncus bufonius var. occidentalis	Juncaceae	0.2		0.5	1.0	0.3	1.0	0.3	0.47	0.86	0.40	3.3
Erodium botrys*	Geraniaceae	0.1	0.7	0.2	0.5	0.1	1.0	0.2	0.40	1.00	0.40	2.8
Eleocharis macrostachya	Cyperaceae	2.0		0.2	0.8			1.0	0.57	0.57	0.33	4.0
Bromus hordeaceus*	Poaceae			0.2	1.0	0.2	0.1	1.0	0.36	0.71	0.26	2.5
Callitriche heterophylla var. bolanderi	Callitrichaceae	0.5				1.0		2.0	0.50	0.43	0.21	3.5
Vulpia bromoides*	Poaceae	0.1	0.1		1.0		0.1	0.7	0.29	0.71	0.20	2.0
Myosurus minimus+	Ranunculaceae	0.1	0.1				2.0	0.1	0.33	0.57	0.19	2.3
Mimulus tricolor+	Scrophulariaceae	0.1	0.2	0.3	0.5		0.1	0.2	0.20	0.86	0.17	1.4
Psilocarphus oregonus+	Asteraceae	0.1	0.5	0.2			0.1	0.5	0.20	0.71	0.14	1.4
Eremocarpus setigerus	Euphorbiaceae		0.1	0.1	0.1	0.2	0.3	0.3	0.16	0.86	0.13	1.1
Ranunculus bonariensis var. trisepalus+	Ranunculaceae	0.3	1.0			0.1			0.20	0.43	0.09	1.4
Veronica peregrina ssp. xalapensis	Scrophulariaceae		0.2	0.1	0.2	0.1		0.1	0.10	0.71	0.07	0.7
Cerastium glomeratum*	Caryophyllaceae	0.1	0.1	0.2	0.2			0.1	0.10	0.71	0.07	0.7
Elatine californica	Elatinaceae	0.5	0.1		0.5				0.16	0.43	0.07	1.1
Brodiaea sp. (vegetative plant foliage)	Liliaceae	0.1			0.7			0.3	0.16	0.43	0.07	1.1
Trifolium depauperatum var. depauperatum	Fabaceae	0.1	0.1			0.1	0.1	0.2	0.09	0.71	0.06	0.6
Calandrinia ciliata	Portulacaceae	0.1	0.1	0.1	0.1			0.1	0.07	0.71	0.05	0.5
Navarretia leucocephala ssp. leucocephala+	Polemonaceae			1.0		0.2			0.17	0.29	0.05	1.2
Lactuca serriola*	Asteraceae	0.1		0.2	0.2			0.1	0.09	0.57	0.05	0.6
Lolium perenne*	Poaceae	0.3		0.1	0.1	0.1			0.09	0.57	0.05	0.6
Trifolium depauperatum var. amplectens	Fabaceae		0.1	0.3	0.3				0.10	0.43	0.04	0.7
Downingia bicornuta var. bicornuta+	Campanulaceae	0.2		0.2	0.2				0.09	0.43	0.04	0.6
Trichostema lanceolata	Lamiaceae			0.1	0.1	0.1	0.1		0.06	0.57	0.03	0.4
Stellaria media*	Caryophyllaceae	0.1		0.1	0.2				0.06	0.43	0.02	0.4
Phalaris lemmonii	Poaceae	0.1		0.1				0.1	0.04	0.43	0.02	0.3
Cicendia quadrangularis+	Gentianaceae	0.1					0.1	0.1	0.04	0.43	0.02	0.3
Montia fontana+	Portulacaceae	0.1	0.1		0.1				0.04	0.43	0.02	0.3
Trifolium gracilentum var. gracilentum	Fabaceae	0.1		0.1	0.1				0.04	0.43	0.02	0.3
Plagiobothrys leptoclada+	Boraginaceae	0.2	0.2						0.06	0.29	0.02	0.4

Table 2: Vernal Pool Species of Importance
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Maximum Absolute % Cover Pool A	Maximum Absolute % Cover Pool B	Maximum Absolute % Cover Pool C	Maximum Absolute % Cover Pool D	Maximum Absolute % Cover Pool E	Maximum Absolute % Cover Pool F	Maximum Absolute % Cover Pool G	Average Absolute % Cover	Frequency Found	Importance Value 1 (Avg Cover x Frequency)	Importance Value 2 (Cover Sum all Pools)
Poa annua*	Poaceae	0.2		0.2					0.06	0.29	0.02	0.4
Juncus uncialis+	Juncaceae					0.1		0.1	0.03	0.29	0.01	0.2
Lupinus bicolor	Fabaceae			0.1	0.1				0.03	0.29	0.01	0.2
Chamomilla suaveolens*	Asteraceae	0.1			0.1				0.03	0.29	0.01	0.2
Holocarpha virgata ssp. virgata	Asteraceae			0.1	0.1				0.03	0.29	0.01	0.2
Medicago polymorpha*	Fabaceae		0.1		0.1				0.03	0.29	0.01	0.2
Crassula tillaea*	Crassulaceae			0.1	0.1				0.03	0.29	0.01	0.2
Isoetes orcuttii+	Isoetaceae	0.1					0.1		0.03	0.29	0.01	0.2
Erodium cicutarium*	Geraniaceae		0.1				0.1		0.03	0.29	0.01	0.2
Senecio vulgaris*	Asteraceae				0.1			0.1	0.03	0.29	0.01	0.2
Ranunculus aquatilis var. hispidulus	Ranunculaceae			0.3					0.04	0.14	0.01	0.3
Alopecurus saccatus+	Poaceae	0.2							0.03	0.14	0.00	0.2
Sidalcea calycosa	Malvaceae				0.1				0.01	0.14	0.00	0.1
Polygonum arenastrum*	Polygonaceae			0.1					0.01	0.14	0.00	0.1
Silene gallica*	Caryophyllaceae		0.1						0.01	0.14	0.00	0.1
Trifolium microcephalum	Fabaceae	0.1							0.01	0.14	0.00	0.1
Mimulus guttatus	Scrophulariaceae			0.1					0.01	0.14	0.00	0.1
Trifolium ciliolatum	Fabaceae				0.1				0.01	0.14	0.00	0.1
Polypogon monspeliensis*	Poaceae	0.1							0.01	0.14	0.00	0.1
Epilobium brachycarpum	Onagraceae			0.1					0.01	0.14	0.00	0.1
Centunculus minimus+	Primulaceae						0.1		0.01	0.14	0.00	0.1
									MEAN		1.04	7.72
									Standard Deviation		3.69	25.94

+ Vernal pool endemic species (as per Attachment B, Scope of Work, Contract Order Number DACW05-95-P-0795).
* Species introduced or naturalized, but not considered native, in California.

Table 3: Vernal Pool A
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Alopecurus saccatus+	Poaceae		0.2	0.2	0.36
Brodiaea sp. (vegetative plant foliage)	Liliaceae	0.1		0.1	0.18
Calandrinia ciliata	Portulacaceae	0.1		0.1	0.18
Callitriche heterophylla var. bolanderi	Callitrichaceae	0.5	0.1	0.5	0.91
Callitriche marginata+	Callitrichaceae	0.2	0.2	0.2	0.36
Cerastium glomeratum*	Caryophyllaceae	0.1	0.1	0.1	0.18
Chamomilla suaveolens*	Asteraceae	0.1	0.1	0.1	0.18
Cicendia quadrangularis+	Gentianaceae		0.1	0.1	0.18
Crassula aquatica	Crassulaceae	0.2	1.0	1.0	1.82
Downingia bicornuta var. bicornuta+	Campanulaceae		0.2	0.2	0.36
Downingia ornatissima var. ornatissima+	Campanulaceae		1.0	1.0	1.82
Elatine californica	Elatinaceae		0.5	0.5	0.91
Eleocharis macrostachya	Cyperaceae	2.0	1.0	2.0	3.64
Epilobium densiflorum	Onagraceae		15.0	15.0	27.27
Erodium botrys*	Geraniaceae	0.1	0.1	0.1	0.18
Eryngium vaseyi+	Apiaceae	8.0	12.0	12.0	21.82
Hemizonia fitchii	Asteraceae	0.2	0.1	0.2	0.36
Hordeum marinum ssp. gussoneanum*	Poaceae	3.0	1.0	3.0	5.45
Isoetes orcuttii+	Isoetaceae	0.1		0.1	0.18
Juncus bufonius var. occidentalis	Juncaceae	0.2	0.2	0.2	0.36
Lactuca serriola*	Asteraceae		0.1	0.1	0.18
Lolium perenne*	Poaceae	0.3	0.1	0.3	0.55
Lythrum hyssopifolia*	Lythracaceae		0.4	0.4	0.73
Mimulus tricolor+	Scrophulariaceae		0.1	0.1	0.18
Montia fontana+	Portulacaceae	0.1	0.1	0.1	0.18
Myosurus minimus+	Ranunculaceae		0.1	0.1	0.18
Phalaris lemmonii	Poaceae		0.1	0.1	0.18
Pilularia americana+	Marsileaceae		0.7	0.7	1.27
Plagiobothrys greenei+	Boraginaceae	1.0	0.3	1.0	1.82
Plagiobothrys leptoclada+	Boraginaceae		0.2	0.2	0.36
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		12.0	12.0	21.82
Poa annua*	Poaceae	0.2		0.2	0.36
Polypogon monspeliensis*	Poaceae		0.1	0.1	0.18
Psilocarphus brevissimus var. brevissimus+	Asteraceae	0.1	2.0	2.0	3.64
Psilocarphus oregonus+	Asteraceae		0.1	0.1	0.18
Ranunculus bonariensis var. trisepalus+	Ranunculaceae	0.3	0.3	0.3	0.55
Stellaria media*	Caryophyllaceae	0.1	0.1	0.1	0.18
Trifolium depauperatum var. depauperatum	Fabaceae		0.1	0.1	0.18
Trifolium gracilentum var. gracilentum	Fabaceae		0.1	0.1	0.18
Trifolium microcephalum	Fabaceae		0.1	0.1	0.18
Vulpia bromoides*	Poaceae	0.1	0.1	0.1	0.18
TOTAL VEGETATIVE COVER		17.1	50.1	55.0	100.00
bare soil, rocks, or cobbles		2.0	45.0		
standing water		95.0	5.0		
bryophytes and lichens		0.1			
animal droppings		0.3	0.4		
TOTAL ALL COVER CATEGORIES		114.5	100.5		

Richness and Diversity

Species Richness - All Plants	41
Species Richness - Vernal Pool Endemics+	17
Species Richness - Other Natives	13
Species Richness - Non-Native Species*	11
Shannon Weaver Index (Diversity) - H'	2.23

Relative Cover Contributions

Table 4: Vernal Pool B
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Calandrinia ciliata	Portulacaceae	0.1		0.1	0.14
Callitriche marginata+	Callitrichaceae	2.0	0.5	2.0	2.73
Cerastium glomeratum*	Caryophyllaceae	0.1	0.1	0.1	0.14
Crassula aquatica	Crassulaceae	1.0	4.0	4.0	5.46
Downingia ornatissima var. ornatissima+	Campanulaceae		0.1	0.1	0.14
Elatine californica	Elatinaceae		0.1	0.1	0.14
Epilobium densiflorum	Onagraceae	0.1	20.0	20.0	27.32
Eremocarpus setigerus	Euphorbiaceae		0.1	0.1	0.14
Erodium botrys*	Geraniaceae		0.7	0.7	0.96
Erodium cicutarium*	Geraniaceae		0.1	0.1	0.14
Eryngium vaseyi+	Apiaceae	15.0	30.0	30.0	40.98
Hemizonia fitchii	Asteraceae	0.2	0.8	0.8	1.09
Hordeum marinum ssp. gussoneanum*	Poaceae	3.0	2.0	3.0	4.10
Lythrum hyssopifolia*	Lythracaceae	1.0	0.5	1.0	1.37
Medicago polymorpha*	Fabaceae		0.1	0.1	0.14
Mimulus tricolor+	Scrophulariaceae		0.2	0.2	0.27
Montia fontana+	Portulacaceae	0.1	0.1	0.1	0.14
Myosurus minimus+	Ranunculaceae		0.1	0.1	0.14
Pilularia americana+	Marsileaceae	0.1	0.3	0.3	0.41
Plagiobothrys greenei+	Boraginaceae	1.0	0.2	1.0	1.37
Plagiobothrys leptoclada+	Boraginaceae		0.2	0.2	0.27
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		7.0	7.0	9.56
Psilocarphus oregonus+	Asteraceae	0.1	0.5	0.5	0.68
Ranunculus bonariensis var. trisepalus+	Ranunculaceae	1.0	0.1	1.0	1.37
Silene gallica*	Caryophyllaceae		0.1	0.1	0.14
Trifolium depauperatum var. amplectens	Fabaceae		0.1	0.1	0.14
Trifolium depauperatum var. depauperatum	Fabaceae	0.1	0.1	0.1	0.14
Veronica peregrina ssp. xalapensis	Scrophulariaceae	0.1	0.2	0.2	0.27
Vulpia bromoides*	Poaceae		0.1	0.1	0.14
TOTAL VEGETATIVE COVER		25.0	68.4	73.2	100.00
bare soil, rocks, or cobbles		1.0	35.0		
standing water		90.0			
animal droppings		1.0	0.5		
TOTAL ALL COVER CATEGORIES		117.0	103.9		

Richness and Diversity

Species Richness - All Plants	29
Species Richness - Vernal Pool Endemics+	12
Species Richness - Other Plants	9
Species Richness - Non-Native Species*	8
Shannon Weaver Index (Diversity) - H'	1.82

Relative Cover Contributions

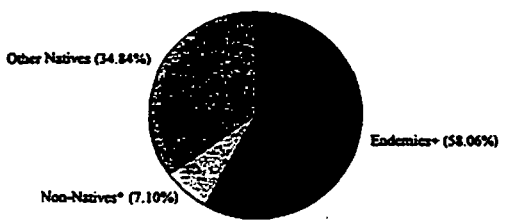


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Table 5: Vernal Pool C
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Bromus hordeaceus*	Poaceae		0.2	0.2	0.31
Calandrinia ciliata	Portulacaceae	0.1		0.1	0.16
Callitriche marginata+	Callitrichaceae	0.5	0.5	0.5	0.78
Cerastium glomeratum*	Caryophyllaceae	0.2		0.2	0.31
Crassula aquatica	Crassulaceae	1.0	3.0	3.0	4.69
Crassula tillaea*	Crassulaceae	0.1		0.1	0.16
Downingia bicornuta var. bicornuta+	Campanulaceae		0.2	0.2	0.31
Downingia ornatissima var. ornatissima+	Campanulaceae		1.0	1.0	1.56
Eleocharis macrostachya	Cyperaceae		0.2	0.2	0.31
Epilobium brachycarpum	Onagraceae	0.1		0.1	0.16
Epilobium densiflorum	Onagraceae	0.1	8.0	8.0	12.52
Eremocarpus setigerus	Euphorbiaceae		0.1	0.1	0.16
Erodium botrys*	Geraniaceae	0.1	0.2	0.2	0.31
Eryngium vaseyi+	Apiaceae	22.0	25.0	25.0	39.12
Hemizonia fitchii	Asteraceae	0.3	2.0	2.0	3.13
Holocarpha virgata ssp. virgata	Asteraceae		0.1	0.1	0.16
Hordeum marinum ssp. gussoneanum*	Poaceae	1.0	1.0	1.0	1.56
Juncus bufonius var. occidentalis	Juncaceae	0.1	0.5	0.5	0.78
Lactuca serriola*	Asteraceae	0.1	0.2	0.2	0.31
Lolium perenne*	Poaceae	0.1	0.1	0.1	0.16
Lupinus bicolor	Fabaceae		0.1	0.1	0.16
Lythrum hyssopifolia*	Lythracaceae	3.0	4.0	4.0	6.26
Mimulus guttatus	Scrophulariaceae	0.1		0.1	0.16
Mimulus tricolor+	Scrophulariaceae		0.3	0.3	0.47
Navarretia leucocephala ssp. leucocephala+	Polemonaceae		1.0	1.0	1.56
Phalaris lemmonii	Poaceae		0.1	0.1	0.16
Pilularia americana+	Marsileaceae		0.5	0.5	0.78
Plagiobothrys greenei+	Boraginaceae	0.5	0.2	0.5	0.78
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		10.0	10.0	15.65
Poa annua*	Poaceae	0.2	0.1	0.2	0.31
Polygonum arenastrum*	Polygonaceae		0.1	0.1	0.16
Psilocarphus brevissimus var. brevissimus+	Asteraceae		3.0	3.0	4.69
Psilocarphus oregonus+	Asteraceae		0.2	0.2	0.31
Ranunculus aquatilis var. hispidulus	Ranunculaceae		0.3	0.3	0.47
Stellaria media*	Caryophyllaceae	0.1		0.1	0.16
Trichostema lanceolata	Lamiaceae		0.1	0.1	0.16
Trifolium depauperatum var. amplectens	Fabaceae	0.1	0.3	0.3	0.47
Trifolium gracilentum var. gracilentum	Fabaceae		0.1	0.1	0.16
Veronica peregrina ssp. xalapensis	Scrophulariaceae		0.1	0.1	0.16
TOTAL VEGETATIVE COVER		29.8	62.8	63.9	100.00
bare soil, rocks, or cobbles		1.0	35.0		
standing water		90.0	1.0		
bryophytes and lichens		0.1			
animal droppings		1.0	0.5		
litter, garbage, other		0.1	0.1		
TOTAL ALL COVER CATEGORIES		122.0	99.4		

Relative Cover Contributions

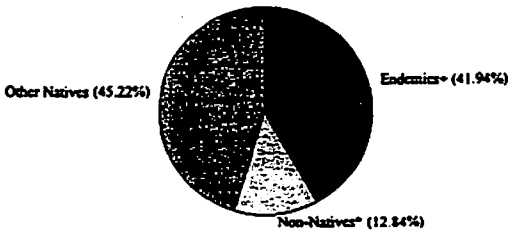
Richness and Diversity

Species Richness - All Plants	39
Species Richness - Vernal Pool Endemics+	11
Species Richness - Other Natives	17
Species Richness - Non-Native Species*	11
Shannon Weaver Index (Diversity) - H'	2.20

Table 6: Vernal Pool D
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Brodiaea sp. (vegetative plant foliage)	Liliaceae	0.7		0.7	1.04
Bromus hordeaceus*	Poaceae		1.0	1.0	1.49
Calandrinia ciliata	Portulacaceae	0.1		0.1	0.15
Callitriche marginata+	Callitrichaceae	0.2	0.3	0.3	0.45
Cerastium glomeratum*	Caryophyllaceae		0.2	0.2	0.30
Chamomilla suaveolens*	Asteraceae		0.1	0.1	0.15
Crassula aquatica	Crassulaceae	0.1	20.0	20.0	29.85
Crassula tillaea*	Crassulaceae	0.1	0.1	0.1	0.15
Downingia bicornuta var. bicornuta+	Campanulaceae		0.2	0.2	0.30
Downingia ornatissima var. ornatissima+	Campanulaceae		3.0	3.0	4.48
Elatine californica	Elatinaceae		0.5	0.5	0.75
Eleocharis macrostachya	Cyperaceae	0.8		0.8	1.19
Epilobium densiflorum	Onagraceae	0.1	4.0	4.0	5.97
Eremocarpus setigerus	Euphorbiaceae		0.1	0.1	0.15
Erodium botrys*	Geraniaceae	0.1	0.5	0.5	0.75
Eryngium vaseyi+	Apiaceae	12.0	12.0	12.0	17.91
Hemizonia fitchii	Asteraceae	0.2	2.0	2.0	2.99
Holocarpha virgata ssp. virgata	Asteraceae		0.1	0.1	0.15
Hordeum marinum ssp. gussoneanum*	Poaceae		1.0	1.0	1.49
Juncus bufonius var. occidentalis	Juncaceae	0.2	1.0	1.0	1.49
Lactuca serriola*	Asteraceae		0.2	0.2	0.30
Lolium perenne*	Poaceae	0.1		0.1	0.15
Lupinus bicolor	Fabaceae	0.1	0.1	0.1	0.15
Lythrum hyssopifolia*	Lythracaceae	2.0	4.0	4.0	5.97
Medicago polymorpha*	Fabaceae		0.1	0.1	0.15
Mimulus tricolor+	Scrophulariaceae		0.5	0.5	0.75
Montia fontana+	Portulacaceae	0.1		0.1	0.15
Pilularia americana+	Marsileaceae	0.1	1.0	1.0	1.49
Plagiobothrys greenei+	Boraginaceae	1.0	0.1	1.0	1.49
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		7.0	7.0	10.45
Psilocarphus brevissimus var. brevissimus+	Asteraceae	0.3	3.0	3.0	4.48
Senecio vulgaris*	Asteraceae	0.1	0.1	0.1	0.15
Sidalcea calycosa	Malvaceae	0.1		0.1	0.15
Stellaria media*	Caryophyllaceae	0.2		0.2	0.30
Trichostema lanceolata	Lamiaceae		0.1	0.1	0.15
Trifolium ciliolatum	Fabaceae		0.1	0.1	0.15
Trifolium depauperatum var. amplectens	Fabaceae	0.1	0.3	0.3	0.45
Trifolium gracilentum var. gracilentum	Fabaceae		0.1	0.1	0.15
Veronica peregrina ssp. xalapensis	Scrophulariaceae	0.1	0.2	0.2	0.30
Vulpia bromoides*	Poaceae		1.0	1.0	1.49
TOTAL VEGETATIVE COVER		18.9	64.0	67.0	100.00
bare soil, rocks, or cobbles		2.0	35.0		
standing water		90.0	1.0		
algae or algal matting		0.1			
bryophytes and lichens		0.1			
animal droppings		1.0	1.0		
TOTAL ALL COVER CATEGORIES		112.1	101.0		

Relative Cover Contributions



Richness and Diversity

Species Richness - All Plants	40
Species Richness - Vernal Pool Endemics+	10
Species Richness - Other Natives	17
Species Richness - Non-Native Species*	13
Shannon Weaver Index (Diversity) - H'	2.48

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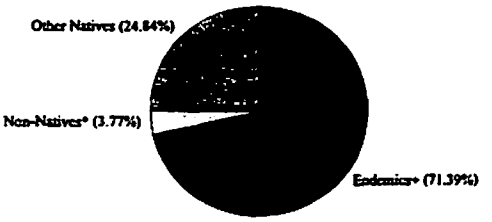
Table 7: Vernal Pool E
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Bromus hordeaceus*	Poaceae		0.2	0.2	0.26
Callitriche heterophylla var. bolanderi	Callitrichaceae	1.0		1.0	1.30
Callitriche marginata+	Callitrichaceae	0.5	0.2	0.5	0.65
Crassula aquatica	Crassulaceae	0.1	15.0	15.0	19.51
Downingia ornatissima var. ornatissima+	Campanulaceae		1.0	1.0	1.30
Epilobium densiflorum	Onagraceae		2.0	2.0	2.60
Eremocarpus setigerus	Euphorbiaceae		0.2	0.2	0.26
Erodium botrys*	Geraniaceae		0.1	0.1	0.13
Eryngium vaseyi+	Apiaceae	30.0	30.0	30.0	39.01
Hemizonia fitchii	Asteraceae	0.1	0.3	0.3	0.39
Hordeum marinum ssp. gussoneanum*	Poaceae	2.0	1.0	2.0	2.60
Juncus bufonius var. occidentalis	Juncaceae	0.1	0.3	0.3	0.39
Juncus uncialis+	Juncaceae		0.1	0.1	0.13
Lolium perenne*	Poaceae		0.1	0.1	0.13
Lythrum hyssopifolia*	Lythracaceae	0.5	0.5	0.5	0.65
Navarretia leucocephala ssp. leucocephala+	Polemonaceae		0.2	0.2	0.26
Pilularia americana+	Marsileaceae		2.0	2.0	2.60
Plagiobothrys greenei+	Boraginaceae	1.0	0.1	1.0	1.30
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		10.0	10.0	13.00
Psilocarphus brevissimus var. brevissimus+	Asteraceae	0.3	10.0	10.0	13.00
Ranunculus bonariensis var. trisepalus+	Ranunculaceae	0.1	0.1	0.1	0.13
Trichostema lanceolata	Lamiaceae		0.1	0.1	0.13
Trifolium depauperatum var. depauperatum	Fabaceae		0.1	0.1	0.13
Veronica peregrina ssp. xalapensis	Scrophulariaceae		0.1	0.1	0.13
TOTAL VEGETATIVE COVER		35.7	73.7	76.9	100.00
bare soil, rocks, or cobbles		2.0	25.0		
standing water		90.0			
bryophytes and lichens		0.1			
animal droppings		1.0			
litter, garbage, other		0.1			
TOTAL ALL COVER CATEGORIES		128.9	98.7		

Relative Cover Contributions



Richness and Diversity

Species Richness - All Plants	24
Species Richness - Vernal Pool Endemics+	10
Species Richness - Other Natives	9
Species Richness - Non-Native Species*	5
Shannon Weaver Index (Diversity) - H'	1.89

Table 8: Vernal Pool F
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Bromus hordeaceus*	Poaceae		0.1	0.1	0.17
Callitriche marginata+	Callitrichaceae	3.0	0.1	3.0	5.13
Centunculus minimus+	Primulaceae		0.1	0.1	0.17
Cicendia quadrangularis+	Gentianaceae		0.1	0.1	0.17
Crassula aquatica	Crassulaceae	0.5	5.0	5.0	8.55
Downingia ornatissima var. ornatissima+	Campanulaceae		0.1	0.1	0.17
Eremocarpus setigerus	Euphorbiaceae	0.3	0.2	0.3	0.51
Erodium botrys*	Geraniaceae	1.0	0.1	1.0	1.71
Erodium cicutarium*	Geraniaceae		0.1	0.1	0.17
Eryngium vaseyi+	Apiaceae	35.0	20.0	35.0	59.83
Hemizonia fitchii	Asteraceae	0.8	2.0	2.0	3.42
Hordeum marinum ssp. gussoneanum*	Poaceae	3.0	1.0	3.0	5.13
Isoetes orcuttii+	Isoetaceae	0.1		0.1	0.17
Juncus bufonius var. occidentalis	Juncaceae	0.2	1.0	1.0	1.71
Lythrum hyssopifolia*	Lythracaceae	1.0	1.0	1.0	1.71
Mimulus tricolor+	Scrophulariaceae		0.1	0.1	0.17
Myosurus minimus+	Ranunculaceae	2.0	0.5	2.0	3.42
Pilularia americana+	Marsileaceae	0.1	1.0	1.0	1.71
Plagiobothrys greenei+	Boraginaceae	2.0	0.1	2.0	3.42
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		1.0	1.0	1.71
Psilocarphus brevissimus var. brevissimus+	Asteraceae		0.1	0.1	0.17
Psilocarphus oregonus+	Asteraceae	0.1	0.1	0.1	0.17
Trichostema lanceolata	Lamiaceae		0.1	0.1	0.17
Trifolium depauperatum var. depauperatum	Fabaceae	0.1		0.1	0.17
Vulpia bromoides*	Poaceae		0.1	0.1	0.17
TOTAL VEGETATIVE COVER		49.2	34.0	58.5	100.00
bare soil, rocks, or cobbles		40.0	35.0		
standing water		20.0			
algae or algal matting		1.0	30.0		
bryophytes and lichens		0.2			
animal droppings		3.0	1.0		
litter, garbage, other					
TOTAL ALL COVER CATEGORIES		113.4	100.0		

Richness and Diversity

Species Richness - All Plants	25
Species Richness - Vernal Pool Endemics+	13
Species Richness - Other Natives	6
Species Richness - Non-Native Species*	6
Shannon Weaver Index (Diversity) - H'	1.67

Relative Cover Contributions

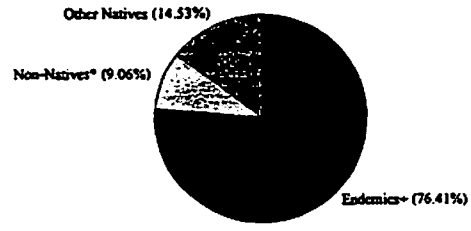


Table 9: Vernal Pool G
Merced County Streams Project, Castle Dam Unit

Species Name	Family	Absolute % Cover 3/6/95	Absolute % Cover 4/23/95	Maximum Absolute % Cover	Maximum Relative % Cover
Brodiaea sp. (vegetative plant foliage)	Liliaceae	0.3		0.3	0.36
Bromus hordeaceus*	Poaceae		1.0	1.0	1.19
Calandrinia ciliata	Portulacaceae	0.1		0.1	0.12
Callitriche heterophylla var. bolanderi	Callitrichaceae	2.0		2.0	2.38
Callitriche marginata+	Callitrichaceae	0.3	0.5	0.5	0.59
Cerastium glomeratum*	Caryophyllaceae	0.1		0.1	0.12
Cicendia quadrangularis+	Gentianaceae		0.1	0.1	0.12
Crassula aquatica	Crassulaceae	0.2	5.0	5.0	5.95
Downingia ornatissima var. ornatissima+	Campanulaceae	-	1.0	1.0	1.19
Eleocharis macrostachya	Cyperaceae	1.0	0.3	1.0	1.19
Epilobium densiflorum	Onagraceae		2.0	2.0	2.38
Eremocarpus setigerus	Euphorbiaceae	0.1	0.3	0.3	0.36
Erodium botrys*	Geraniaceae	0.2	0.2	0.2	0.24
Eryngium vaseyi+	Apiaceae	45.0	20.0	45.0	53.51
Hemizonia fitchii	Asteraceae	0.2	2.0	2.0	2.38
Hordeum marinum ssp. gussoneanum*	Poaceae		2.0	2.0	2.38
Juncus bufonius var. occidentalis	Juncaceae	0.1	0.3	0.3	0.36
Juncus uncialis+	Juncaceae		0.1	0.1	0.12
Lactuca serriola*	Asteraceae	0.1	0.1	0.1	0.12
Lythrum hyssopifolia*	Lythraceae	1.0	2.0	2.0	2.38
Mimulus tricolor+	Scrophulariaceae		0.2	0.2	0.24
Myosurus minimus+	Ranunculaceae		0.1	0.1	0.12
Phalaris lemmonii	Poaceae		0.1	0.1	0.12
Pilularia americana+	Marsileaceae	0.1	5.0	5.0	5.95
Plagiobothrys greenei+	Boraginaceae	1.0	0.2	1.0	1.19
Plagiobothrys stipitatus var. micranthus+	Boraginaceae		8.0	8.0	9.51
Psilocarphus brevissimus var. brevissimus+	Asteraceae	0.5	3.0	3.0	3.57
Psilocarphus oregonus+	Asteraceae		0.5	0.5	0.59
Senecio vulgaris*	Asteraceae	0.1		0.1	0.12
Trifolium depauperatum var. depauperatum	Fabaceae	0.1	0.2	0.2	0.24
Veronica peregrina ssp. xalapensis	Scrophulariaceae		0.1	0.1	0.12
Vulpia bromoides*	Poaceae		0.7	0.7	0.83
TOTAL VEGETATIVE COVER		52.5	55.0	84.1	100.00
bare soil, rocks, or cobbles		1.0	45.0		
standing water		80.0	1.0		
algae or algal matting		1.0			
bryophytes and lichens		0.1			
animal droppings			0.5		
TOTAL ALL COVER CATEGORIES		134.6	101.5		

Richness and Diversity

Species Richness - All Plants	32
Species Richness - Vernal Pool Endemics+	12
Species Richness - Other Natives	12
Species Richness - Non-Native Species*	8
Shannon Weaver Index (Diversity) - H'	1.94

Relative Cover Contributions

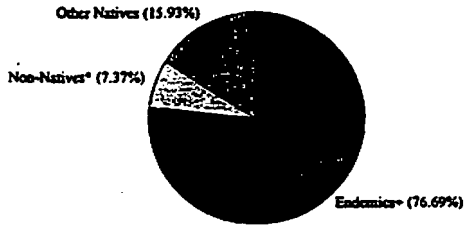
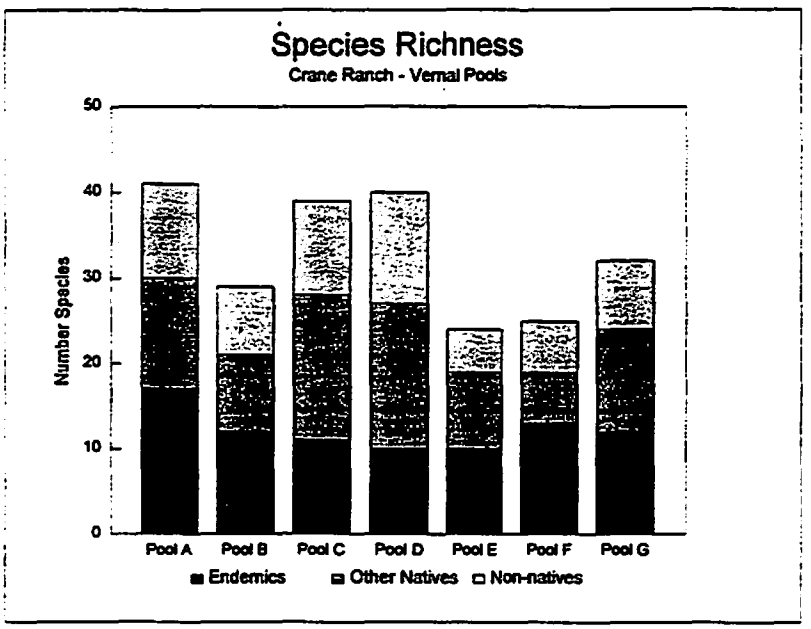


Table 10: Species Richness and Diversity Comparison for the Vernal Pools
Merced County Stream Project, Castle Dam Unit

	Pool A	Pool B	Pool C	Pool D	Pool E	Pool F	Pool G	Mean	StdDev
Number of Species									
Endemics	17	12	11	10	10	13	12	12.14	2.23
Other Natives	13	9	17	17	9	6	12	11.86	3.87
Non-natives	11	8	11	13	5	6	8	8.86	2.70
Total Species Richness	41	29	39	40	24	25	32	32.86	6.66
Diversity - H'	2.23	1.82	2.2	2.48	1.89	1.67	1.94	2.03	0.26



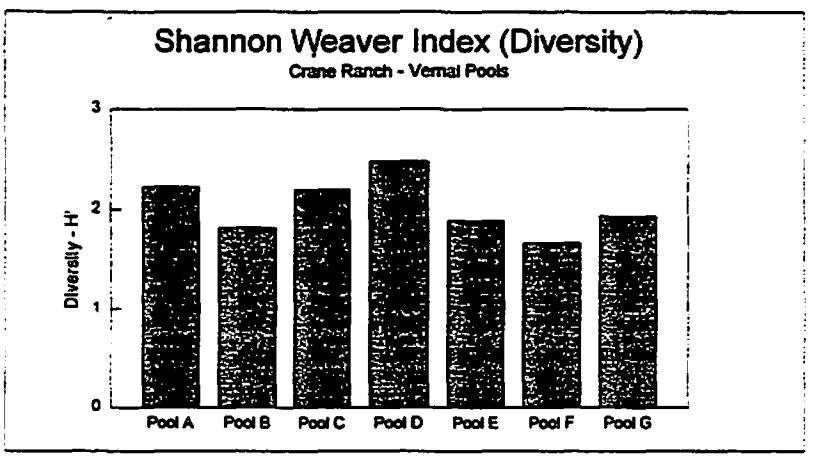


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Table 11: Summary of aquatic (invertebrate) survey of vernal pools.

Aquatic (Invertebrate) Survey	Vernal Pool Designation						
	A	B	C	D	E	F	G
Eubranchiopoda (fairy shrimp) *Linderiella occidentalis*	x	-	x	x	-	-	-
Ostracoda (ostracods)	x	x	x	x	-	-	-
Copepoda (copepods)	x	-	x	-	x	-	-
Cladocera (daphnia)	-	x	-	-	-	-	-
Hydracerina (water mites)	x	x	-	-	-	-	-
Diptera (fly, mosquito and midge larvae)	x	x	-	-	x	-	-
Hemiptera (waterboatmen, backswimmers & waterstriders)	x	x	-	x	x	-	-
Coleoptera (beetles)	-	-	x	x	x	-	-
Odonata (dragonfly and damselfly larvae)	x	-	-	x	-	-	-
Tadpoles (pacific tree frog)	x	-	x	x	x	-	-

SCOPE OF WORK

BASELINE SURVEY FOR ENVIRONMENTAL COMMITMENTS AT CASTLE RESERVOIR, MERCED COUNTY STREAMS PROJECT

INTRODUCTION

The Merced County Streams, California, project was authorized by Section 201 of the Flood Control Act of December 31, 1970. Phase I of the project, the Castle Dam Unit, includes Castle Dam and Reservoir on Canal Creek and a check structure in the Main Canal. The environmental impacts for Phase I are discussed in the EIS completed by the U.S Army Corps of Engineers (Corps) in 1980. In addition, the EA published by the Corps in 1992 describes the impacts associated with the construction and operation of the check structure on Main Canal. Mitigation for the project was incorporated into the contract specifications for the construction of the dam and into the maintenance manual.

A monitoring plan for environmental commitments was prepared and is to be implemented as part of the operation and maintenance of the Castle Dam Unit. The plan includes periodic evaluation of riparian mitigation measures and vernal pools. The local sponsor has requested a baseline survey prior to taking over operation of the project.

Project Location

The Merced County Stream Project is located in the easterly portion of the San Joaquin Valley, between the Merced and Chowchilla rivers, in Merced and Mariposa Counties, California. The project area lies to the east and north from the city of Merced.

SCOPE OF WORK

The purpose of this Scope of Work is to provide a baseline survey that documents the existing conditions of the vernal pools and riparian vegetation within Castle Reservoir. Two tasks are required in this scope of work: (1) vernal pool surveys and analysis, and (2) riparian surveys and analysis. Each task is described below.

Task 1: Vernal Pool Surveys

Several vernal pools exist within the Castle Reservoir area and may be infrequently flooded. The location of these pools is shown on Attachment A. The long-term affect of infrequent flooding on vernal pool flora and fauna is unknown. A baseline survey is required to document pre-project conditions. The local sponsor will be required to conduct monitoring surveys if and when the vernal pools are inundated by project operation.

Previous Surveys

Coordination with the U.S. Fish and Wildlife Service in 1988 indicated that several Federal candidate and proposed threatened and endangered plant and invertebrate taxa might be found in the area. As a result, a series of five field surveys were conducted by Roy Woodward (1988-92) to locate potential sensitive plant species and habitats in the Castle Reservoir area. During the last two years (1991 and 1992), invertebrates were also targeted in the surveys. No rare plant or invertebrate species were discovered in the reservoir area during any of the surveys. However, during the 1992 survey of some vernal pools just outside the reservoir zone, Woodward found vernal pool fairy shrimp (*Branchinecta lynchi*) and California Linderiella (*Linderiella occidentalis*). The vernal pool fairy shrimp is listed as a Federally threatened species.

Sampling Methodology

Vegetation

At a minimum, the baseline survey will target 3 to 4 plant species that best represent these vernal pools. The survey should include a determination of plant species composition and a cover estimate by the target plant species, vegetative litter, bare soil, rock, and animal disturbance, if any. Any standard quantitative assessment method which provides a statistical comparison of results is acceptable. Each pool should be surveyed twice during each sampling year, once between February 1 and April 1, and a second time between April 2 and June 15 (there should be a minimum of at least two weeks between sampling periods). Also, the dimensions of each pool, as defined by vegetation (average width and length, not depth), will be measured and approximate scale sketches made. The presence of any listed or candidate plant and/or invertebrate species should be noted.

The contractor should inform appropriate landowners at least three days in advance of any field visits and obtain approval for access.

Invertebrates

At a minimum, monitoring will consist of a determination of the presence of absence of hatched individuals, and a qualitative assessment of the density of each species of the following invertebrate taxa (egg collections, soil sample collections, or hydrations are unnecessary):

a. vernal pool tadpole shrimp (*Lepidurus packardi*)

b. vernal pool fairy shrimp (*Branchinecta lynchi*)
c. California linderiella (*Linderiella occidentalis*)
d. conservancy fairy shrimp (*Branchinecta conservatio*)
e. longhorn fairy shrimp (*Branchinecta longiantenna*)

Each pool should be surveyed in conjunction with the vegetation sampling.

Task 2: Riparian Surveys

The Corps and the local sponsor committed to a number of mitigation measures for riparian habitat. They are briefly described below. A more detailed description of these commitments can be found in the September 1992 Final Environmental Assessment for check structure of the Castle Dam Unit. These environmental commitments are complete.

A. Live vegetation along Canal Creek will be left as is except for those areas to be used for borrow and construction. Dead, fallen trees and other debris in the storage pool that present a safety hazard to the dam will be removed.

B. Grade borrow areas to create 2 swales low enough so that riparian will reestablish.

C. Fence 80 acres within the storage pool (borrow areas plus an additional 47 acres), to preclude grazing by livestock. This area will be allowed to revegetate naturally.

D. Topsoil will be stockpiled during construction and later applied to the mitigation (graded borrow area), and other disturbed areas.

E. Disturbed areas will be reseeded with native grasses recommended by the FWS. Disturbed areas were seeded, but not with a native mixture.

F. Brush piles to provide cover for upland species will be created on the mitigation lands just outside the storage pool. Attachment C shows the location of these brush piles.

The baseline survey for riparian should include the following items. A sample checklist is shown in Attachment D.

A) .Condition of the fences at the mitigation area. Note areas that need repair.

B) Describe condition of the brush piles.

C) Within the fenced mitigation area (approximately 80 acres as shown on Attachment C), describe condition of riparian revegetation. Note whether or not riparian is colonizing the area. Note any disturbances - human, livestock, or other animals. If area does not appear to be revegetating with riparian, make recommendations for remediation measures. Provide a schematic drawing noting the location of any new/young riparian.

D) Provide a qualitative description of the existing riparian within the reservoir. This should describe the health and vigor of the existing stand and describe whether any recruitment of new growth is taking place.

E) Provide photographic documentation of both the existing riparian and the newly established riparian within the mitigation area.

F) Note any wildlife or bird use of the area.

REPORTING

The contractor is required to submit both a draft and final report. The draft report is to be complete in all aspects. Three copies of the draft report are required. Following Corps review and comment of the draft report, a final report shall be provided that incorporates comments as appropriate. Three copies of the final report are required. The draft and final reports should contain the following sections:

Section I - Executive summary and introduction, a brief summary of the results, and any proposed changes to the monitoring plan.

Section II - Vernal Pool Vegetation Chapter:

1) Detailed description of sampling method including justification for use of the method.

2) Explanation of methods used for taxonomic descriptions of plants. The location of any voucher specimens should be noted. Note: California threatened or endangered plant species should not be collected without prior approval of the California Department of Fish and Game (CDFG). If any special status plant species, including state listed species, are discovered their identification must be verified by collections or detailed photographs.

3) Photographs showing representative vernal pools and characteristic plant

species.

4) Compilation of vegetation data including tables showing plant species composition by pool, and simple summations (totals,means,standard deviations) of plant cover values by pool.

5) Maps with sketch drawings of pools and approximate dimensions as measured in the field.

6) Data Analysis and discussion of results and findings. Include a discussion of the monitoring procedure and techniques which might be modified for future annual monitoring efforts.

7) Legible copies of original data sheets. These data sheets should contain the date of the survey, names of the surveyors, number/names of pools, brief description of pool location, measured dimensions of pools, and vegetation data. Notes on the data sheet should also mention the hydrologic condition of the pool and any signs of disturbance from livestock or humans.

8) Copies of any Natural Diversity Data Base forms submitted to CDFG.

9) Copies of significant vernal pool literature compiled for this effort.

Section III - Vernal Pool Invertebrate Chapter

1) Detailed description of sampling method including justification for use of the method. The method should be sufficient to reasonably determine presence/absence of hatched individuals of the target invertebrate species if a viable population is present in the pool. Collection of specimens, if necessary, should be made according to standard accepted techniques.

2) Explanation of methods used for taxonomic descriptions of invertebrates. Cite any authorities referenced. The location of any voucher specimens should be noted. Note: it is the responsibility of the contractor to obtain any necessary collection licenses or permits from the state or federal governments.

3) Compilation of invertebrate data including tables showing invertebrate species composition by pool and by pool site.

4) Data Analysis and discussion of results and findings. Include a subjective discussion about the density of the target species and the presence/absence of any other invertebrate taxa. Provide a qualitative assessment of pool water turbidity and temperature as it relates to the target species. Include a discussion of the monitoring procedure and techniques which might be modified

for future monitoring efforts.

5) Legible copies of original data sheets. These data sheets should contain the date of the survey, names of the surveyors, number/names of pools, brief description of pool location, and invertebrate data. Notes on the data sheet should also mention the hydrologic condition of the pool, condition of water turbidity and temperature, and any signs of disturbance from livestock or humans. If observed, note the presence or evidence of any invertebrate predators (snakes, birds, etc.).

6) Copies of any Natural Diversity Data Base forms submitted to CDFG.

7) Copies of significant vernal pool literature compiled for this effort.

Section III - Riparian Vegetation Chapter

This chapter should provide a discussion of the items described under Task 2, Riparian Surveys, and the checklist shown in Attachment D. The checklist may be included in this chapter, as well as any photographs taken to document the riparian.

MATERIALS TO BE PROVIDED BY THE CORPS

The Corps will provide the contractor with copies of all previous surveys of vernal pools within Castle Reservoir.

PERIOD OF SERVICE

The period of service for this contract is to extend to August 30, 1995.

SCHEDULE

The draft survey is due not later than June 30, 1995.
The final survey is due 20 days after the receipt of Corps comments.

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_____. 1991b. Merced County Streams Project Main Canal Check Structure EA: Description of Plant Communities and Potential Project Impacts On Those Communities. Report to U.S. Army Corps of Engineers, Sacramento District.

_____. 1992. Merced County Streams Project - Threatened and Endangered Species Survey 1992. Report to U.S. Army Corps of Engineers, Sacramento District.

California Native Species Field Survey Form

Mail to:

Natural Diversity Data Base
Calif. Dept. of Fish and Game
1416 Ninth Street, 12th Floor
Sacramento, CA 95814

For official use only:

Source Code: _____ Quad Code: _____

Elem. Code: _____ Occ. #: _____

Copy to: _____ Map Index #: _____

Date of Field Work: 25-Jun-1995

Scientific Name: *Ardea herodias - Casmerodius albus* rookery

Species Found? [X] [ ] _____
yes no *If not, why?*

Total # Individuals: ±10 Subsequent visit? [X]yes [ ]no

Compared with your last visit: [ ]more [ ]same [ ]fewer

Is this an existing NDDB Occurrence? [_____] [X] [ ]
yes, occ# no unk.

Collection? If yes: _____ _____
number *Museum/Herbarium*

Reporter: *Roy A. Woodward*
8605 Daimler Way, Sacramento 95828
(916) 682-4137

In Association with:
Carol W.Witham
1028 Cypress Lane, Davis, CA 95616
(916) 753-5872

Plant Information:

Phenology: _____ _____ _____
% vegetative *% flowering* *% fruiting*

Animal Information:

Rookery (breeding site) consisting of at least six nests in large tree growing in shallow water; two nests with young Great Blue Herons.

Location: (Please also attach or draw a map on back)

Castle Dam Reservoir on Canal Creek in Merced County. Approximately 6 miles NW of Merced and 2 miles NNE of Castle Air Force Base.

County: Merced Landowner/Mgr: _____

Quad Name: Winton 7.5' Elevation: 200 ft UTM: _____

T_____ R_____ _____1/4 of _____1/4 SEC _____ T_____ R_____ _____1/4 of _____1/4 SEC _____

Habitat Description: (Plant communities, dominants, associates, substrate/soil, aspect/slope)

Small cluster of trees (*Salix* and *Populus*) growing in shallow standing water of pond (reservoir). Two nests contained young Great Blue Herons. One nest had an adult Great Egret sitting on it. Adult Great Blue Herons were observed sitting on nests and branches as well as flying to and from the trees.

Other rare species? none observed

Site Information:

Castle Dam and Reservoir on Canal Creek are part of the Merced County Streams Project and became operational in 1993. The rookery was not present at this location during preconstruction surveys.

Overall site quality: [ ]excellent [X]good [ ]fair [ ]poor Grazing: [X]none [ ]cattle [ ]sheep [ ]other: _____

Determination: (Check one or more, fill in the blanks)

___ Keyed at a site reference: _____
___ Compared with a specimen housed at: _____
___ Compared with a photo/drawing in: _____
___ By another person (name): _____
X Other: knowledge of taxa

Photographs:

	Slide	Print
Plant/Animal	___	___
Habitat	___	X
Diagnostic Feature	___	___
Other: _____	___	___

May we obtain duplicates? [X]yes [ ]no

CASTLE ROOKERY.WP6 C:\WP60\REPORTS\NDDBFORM.TEM 02-05-95 CWW

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EXHIBIT F
Sheet 46 of 62

EXHIBIT F
Sheet 47 of 62

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPHISC/RELEVE.FRM CWH

SITE NAME: Merced Co. Streams Proj POOL NUMBER: D APPROX SIZE/DEPTH: 270 x 35 ft irregular

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: Witham/Woodward HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/23/1995; INVESTIGATOR: Witham/Woodward HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER MUDDY-SOIL (FULL-BLOOM) PAST-BLOOM DEAD-&-DRY

#| SPECIES NAME	COVER#1	COVER#2
1 Eryngium vaseyi	12	12
2 Sidalcea calycosa	0.1	
3 Stellaria media	0.2	
4 Lolium perenne	0.1	
5 Epilobium ssp densiflorum	0.1	4
6 Lythrum hyssopifolia	2	4
7 Plagiobothrys greenei	1	0.1
8 Biodiea NIF	0.7	
9 Callitriche marginata	1.2	0.3
10 Erodium botrys	0.1	0.5
11 Crassula aquatica	0.1	20
12 Montia fontana	0.1	
13 Hemizonia fitchii	0.2	2
14 Juncus bufonius	0.2	1
15 Trifolium depauperatum amplectens	0.1	0.3
16 Eleocharis macrostachya	0.8	
17 Veronica peregrina	0.1	0.2
18 Senecio vulgaris	0.1	0.1
19 Pillularia americana	0.1	1
20 Psilocarpus brevissimus	0.3	3
21 Lupinus bicolor	0.1	0.1
22 Crassula tillaea	0.1	0.1
23 Calandrinia ciliata	0.1	
24 Plagiobothrys stipitatus micranthus		7
25 Downingia ornatissima		3

#| SPECIES NAME	COVER#1	COVER#2
26 Elatine californica		0.5
27 Downingia bicornuta		0.2
28 Hordeum marinum		1
29 Cerastium glomeratum		0.2
30 Trichostemma lanceolata		0.1
31 Trifolium ciliolatum		0.1
32 Erodiocarpus setigerus		0.1
33 Trifolium gracilentum		0.1
34 Bromus hordeaceus		1
35 Medicago polymorpha		0.1
36 Holocarpha virgata		0.1
37 Mimulus tricolor		0.5
38 Vulpia bromoides		1
39 Lactuca serriola		0.2
40 Chamomilla suaveolens		0.1
TOTAL VEGETATIVE COVER	18.9	64.0
BARE SOIL / ROCKS / COBBLES	2	35
STANDING WATER	90	1
DEAD THATCH / STRAW		
ALGAE / ALGAL MATTING (submerged)	0.1	
BRYOPHYTES / LICHENS	0.1	
ANIMAL DROPPINGS	1	1
LITTER / GARBAGE / OTHER		
TOTAL COVER ALL CATEGORIES	112.1	101.0

[X] SEE REVERSE FOR ADDITIONAL INFORMATION.

Lindernella occidentalis 6 Mar 95.

2

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPMISC/RELEVE.FRM CWW

SITE NAME: Merced Co. Streams Proj. POOL NUMBER: E APPROX SIZE/DEPTH: 160 x 45 ft

1ST SURVEY DATE: 03 /06 /1995; INVESTIGATOR: C.William/R.Woodward HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: ___/___/1995; INVESTIGATOR: _____; HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

#	SPECIES NAME	COVER#1	COVER#2
1	Eryngium vaseyi	30	30
2	Plagiobothrys greenei	1	0.1
3	Lythrum hyssopifolia	0.5	0.5
4	Crassula aquatica	0.1	15
5	Ranunculus bonariensis trisepalus	0.1	0.1
6	Hordeum marinum	2	1
7	Callitriche marginata	0.5	0.2
8	Juncus bufonius	0.1	0.3
9	Callitriche heterophylla	1	
10	Psilocarpus brevissimus	0.3	10
11	Hemizonia fitchii	0.1	0.3
12	Lolium perenne		0.1
13	Epilobium cf densiflorum		2
14	Erodium botrys		0.1
15	Trifolium depauperatum		0.1
16	Veronica peregrina		0.1
17	Pilularia americanus		2
18	Navarretia leucocephala		0.2
19	Erenocarpus setigerus		0.2
20	Bromus hordeaceus		0.2
21	Juncus uncialis		0.1
22	Downingia ornatissima		1
23	Plagiobothrys stipitatus micranthus		10
24	Trichostemma lanceolata		0.1
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
	TOTAL VEGETATIVE COVER	35.7	73.7
	BARE SOIL / ROCKS / COBBLES	2	25
	STANDING WATER	90	
	DEAD THATCH / STRAW		
	ALGAE / ALGAL MATTING (submerged)		
	BRYOPHYTES / LICHENS	0.1	
	ANIMAL DROPPINGS	1	
	LITTER / GARBAGE / OTHER	0.1	
	TOTAL COVER ALL CATEGORIES	128.9	98.7

[X] SEE REVERSE FOR ADDITIONAL INFORMATION.

no fairy shrimp 3/6/95.

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPMISC/RELEVE.FRM CWW

SITE NAME: Mercer Co. Streams Proj. POOL NUMBER: C APPROX SIZE/DEPTH: 109 x 99 ft + lobe (20x107 ft)

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: Cathan/Woodward HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/03/1995; INVESTIGATOR: Cathan/Woodward HYDROLIC/FLORISTIC STAGE: AQUATIC (WET-CENTER) MUDDY-SOIL (FULL-BLOOM) PAST-BLOOM DEAD-&-DRY

#	SPECIES NAME	COVER#1	COVER#2
1	Eryngium vaseyi	22	25
2	Lythrum hyssopifolia	3	9
3	Crassula aquatica	1	3
4	Callitriche marginata	0.5	0.5
5	Crastium glomeratum	0.2	
6	Hordeum marinum	1	1
7	Hemizonia fitchii	0.3	2
8	Juncus bufonius	0.1	0.5
9	Mimulus guttatus	0.1	
10	Plagiobothrys greenei	0.5	0.2
11	Calandrinia ciliata	0.1	
12	Epilobium cf brachycarpum	0.1	
13	Stellaria media	0.1	
14	Lactuca serriola	0.1	0.2
15	Erodium botrys	0.1	0.2
16	Epilobium cf densiflorum	0.1	8
17	Trifolium depauperatum amplectens	0.1	0.3
18	Crassula tillaea	0.1	
19	Poa annua	0.2	0.1
20	Lolium perenne	0.1	0.1
21	Pilularia americana		0.5
22	Psilocarpus oregonus		0.2
23	Psilocarpus brevissimus		3
24	Eremocarpus setigerus		0.1
25	Bromus hordeaceus		0.2
26	Eleocharis macrostachya		0.2
27	Mimulus tricolor		0.3
28	Veronica peregrina		0.1
29	Downingia ornatissima		1
30	Polygonum aviculare		0.1
31	Navarretia leucocephala		1
32	Ranunculus aquatilis		0.3
33	Trichostemma lanceolata		0.1
34	Downingia bicornuta		0.2
35	Phalaris lemmonii		0.1
36	Trifolium gracilentum		0.1
37	Lupinus bicolor		0.1
38	Holocarpa virgata		0.1
39	Plagiobothrys stipitatus micranthus		10
40			
	TOTAL VEGETATIVE COVER	22.8	62.8
	BARE SOIL / ROCKS / COBBLES	1	35
	STANDING WATER	90	1
	DEAD THATCH / STRAW		
	ALGAE / ALGAL MATTING (submerged)		
	BRYOPHYTES / LICHENS	0.1	
	ANIMAL DROPPINGS	1	0.5
	LITTER / GARBAGE / OTHER	0.1	0.1
	TOTAL COVER ALL CATEGORIES	122.0	99.4

☑ SEE REVERSE FOR ADDITIONAL INFORMATION.

Linderiella occidentalis 06 Mar 95

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPMISC/RELEVE.FRM CWW

SITE NAME: Merced Co. Streams Proj. POOL NUMBER: 15 APPROX SIZE/DEPTH: 66 x 52 ft

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: [illegible] HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/23/1995;* INVESTIGATOR: C. Witham / R. Woodward HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER (MUDDY-SOIL) (FULL-BLOOM) PAST-BLOOM DEAD-&-DRY

#| SPECIES NAME	COVER#1	COVER#2
1| Cyperus difformis	15	30
2| [illegible] bisepalus	1	0.1
3| Callitriche marginata	[illegible]	0.5
4| Lythrum hyssopifolia	1	0.5
5| [illegible] fitchii	0.2	0.8
6| [illegible]	0.1	20
7| Pilularia americana	0.1	0.3
8| Psilocarpus oregonus	0.1	0.5
9| Plagiobothrys gracilis	1	0.2
10| Crassula aquatica	1	4
11| Hordeum marinum	3	2
12| Veronica peregrina	0.1	0.2
13| Montia fontana	0.1	0.1
14| Trifolium depauperatum	0.1	0.1
15| Calandrinia ciliata	0.1	—
16| Cerastium glomeratum	0.1	0.1
17| Mimulus tricolor		0.2
18| Plagiobothrys stipitatus micranthus		7
19| Downingia ornatissima		0.1
20| Elatine californica		0.1
21| Eremocarpus setigerus		0.1
22| Trifolium depauperatum amplectens		0.1
23| Medicago polymorpha		0.1
24| Erodium cicutarium		0.1
25| Plagiobothrys leptocladus		0.2

#| SPECIES NAME	COVER#1	COVER#2
26| Vulpia bromoides		0.1
27| Silene gallica		0.1
28| Myosurus minimus		0.1
29| Erodium botrys		0.7
30|		
31|		
32|		
33|		
34|		
35|		
36|		
37| *pool heavily grazed and hog punched		
38|		
39|		
40|		
TOTAL VEGETATIVE COVER	25.0	68.4
BARE SOIL / ROCKS / COBBLES	1	35
STANDING WATER	90	
DEAD THATCH / STRAW		
ALGAE / ALGAL MATTING		
BRYOPHYTES / LICHENS		
ANIMAL DROPPINGS	1	0.5
LITTER / GARBAGE / OTHER		
TOTAL COVER ALL CATEGORIES	117.0	103.9

☑ SEE REVERSE FOR ADDITIONAL INFORMATION.

no fairy shrimp 3/6/95.

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPHISC/RELEVE.FRM CWM

SITE NAME: Merced Co. Streams Proj. POOL NUMBER: A APPROX SIZE/DEPTH: 252 x 163 ft + 20x50 ft lobe

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: [illegible] HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/03/1995; INVESTIGATOR: [illegible] HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER (MUDDY-SOIL) (FULL-BLOOM) PAST-BLOOM DEAD-&-DRY

#	SPECIES NAME	COVER#1	COVER#2
1	Eryngium vaseyi	8	12
2	Eleocharis macrostachya	2	1
3	Juncus bufonius trisepalus	0.3	0.3
4	Hordeum marinum	1.5	0.1
5	Hordeum marinum	3	1
6	Plagiobothrys greenei	1	0.3
7	Cotula coronopifolia	0.2	0.2
8	Crassula aquatica	0.1	1
9	Brodiaea sp.	0.1	
10	Hemizonia fitchii	0.2	0.1
11	Erodium botrys	0.1	0.1
12	Poa annua	0.2	
13	Isoetes cf. orcuttii	0.1	
14	Psilocarphus brevissimus	0.1	2
15	Cerastium glomeratum	0.1	0.1
16	Montia fontana	0.1	0.1
17	Chamomilla suaveolens	0.1	0.1
18	Juncus bufonius	0.2	0.2
19	Vulpia cf. bromoides	0.1	0.1
20	Calandrinia ciliata	0.1	
21	Lolium perenne	0.3	0.1
22	Stellaria media	0.1	0.1
23	Downingia ornatissima		1
24	Downingia bicornuta		0.2
25	Pilularia americana		0.7
	Polypogon monspeliensis		0.1

#	SPECIES NAME	COVER#1	COVER#2
26	Lythrum hyssopifolia		0.4
27	Plagiobothrys stipitatus micranthus		12
28	Epilobium cf densiflorum		15
29	Mimulus tricolor		0.1
30	Lactuca serriola		0.1
31	Trifolium gracilentum		0.1
32	Cicendia quadrangularis		0.1
33	Trifolium depauperatum		0.1
34	Trifolium microdon		0.1
35	Psilocarphus oregonus		0.1
36	Plagiobothrys leptocladus		0.2
37	Alopecurus saccatus		0.2
38	Myosurus minimus		0.1
39	Elatine californica		0.5
40	Phalaris lemmonii		0.1
	TOTAL VEGETATIVE COVER	17.1	50.1
	BARE SOIL / ROCKS / COBBLES	2	45
	STANDING WATER	95	5
	DEAD THATCH / STRAW		
	ALGAE / ALGAL MATTING (aquatic submerged)		
	BRYOPHYTES / LICHENS	0.1	
	ANIMAL DROPPINGS	0.3	0.4
	LITTER / GARBAGE / OTHER		
	TOTAL COVER ALL CATEGORIES	114.5	100.5

☑ SEE REVERSE FOR ADDITIONAL INFORMATION.

Linderiella occidentalis 06 mar 95

8

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPMISC/RELEVE.FRM CMW

SITE NAME: Mercer Co. Sircoins Proj. POOL NUMBER: F APPROX SIZE/DEPTH: 30 x 58 ft oval

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: C. Williams / R. Woodward HYDROLIC/FLORISTIC STAGE: AQUATIC (WET-CENTER) MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/23/1995; INVESTIGATOR: C. Williams / R. Woodward HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER MUDDY-SOIL (FULL-BLOOM) (PAST-BLOOM) DEAD-&-DRY

#	SPECIES NAME	COVER#1	COVER#2
1	Eryngium vaseyi	35	20
2	Myosurus minimus	2	0.5
3	Callitriche marginata	3	0.1
4	Lythrum hyssopifolia	1	1
5	Plagiobothrys greenei	2	0.1
6	Hemizonia fitchii	0.8	2
7	Crassula aquatica	0.5	5
8	Erodium botrys	1	0.1
9	Eremocarpus setigerus	0.3	0.2
10	Trifolium depauperatum	0.1	
11	Juncus bufonius	0.2	1
12	Hordeum murinum	3	1
13	Psilocarpus oregonus	0.1	0.1
14	Pilularia americana	0.1	1
15	Isoetes g. orcutii	0.1	
16	Plagiobothrys stipitatus micranthus		1
17	Mimulus tricolor		0.1
18	Centunculus minimus		0.1
19	Erodium cicutarium		0.1
20	Cicendia quadrangulis		0.1
21	Vulpia bromoides		0.1
22	Bromus hordeaceus		0.1
23	Psilocarpus brevissimus		0.1
24	Trichostemma lanceolata		0.1
25	Downingia ornatissima		0.1
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38	4-23-95 heavily grazed and scuffed		
39	by hooves		
40			
	TOTAL VEGETATIVE COVER	50.2	~~37.8~~
	BARE SOIL / ROCKS / COBBLES	40	35
	STANDING WATER	20	
	DEAD THATCH / STRAW		
	ALGAE / ALGAL MATTING	1	20
	BRYOPHYTES / LICHENS	0.2	
	ANIMAL DROPPINGS	3	1
	LITTER / GARBAGE / OTHER		
	TOTAL COVER ALL CATEGORIES	114.4	100.0 ~~94.8~~

☐ SEE REVERSE FOR ADDITIONAL INFORMATION.

Terrestrial prior to 3/5 rains; no fairy shrimp 3/6 '95

EXHIBIT F
Sheet 52 of 62

VERNAL POOL DATA FORM (RELEVÉ)

95:/VPMISC/RELEVE.FRM CMW

SITE NAME: Merced Co. Stevens Proj. POOL NUMBER: G APPROX SIZE/DEPTH: 70 ft x 30 ft triangle

1ST SURVEY DATE: 03/06/1995; INVESTIGATOR: Cathan, Rubodusard HYDROLIC/FLORISTIC STAGE: (AQUATIC) WET-CENTER MUDDY-SOIL FULL-BLOOM PAST-BLOOM DEAD-&-DRY

2ND SURVEY DATE: 04/23/1995; INVESTIGATOR: Cathan, Rubodusard HYDROLIC/FLORISTIC STAGE: AQUATIC WET-CENTER MUDDY-SOIL (FULL-BLOOM) PAST-BLOOM DEAD-&-DRY

#	SPECIES NAME	COVER#1	COVER#2
1	Eryngium vaseyi	45	20
2	Lythrum hyssopifolia	1	2
3	Callitriche marginata	0.3	0.5
4	Psilocarpus brevissimus	0.5	3
5	Plagiobothrys greenei	1	0.2
6	Crassula aquatica	0.2	5
7	Hemizonia fitchii	0.2	2
8	Juncus bufonius	0.1	0.3
9	Brodiaea NIF	0.3	
10	Callitriche heterophylla	2	
11	Erodium sp.	0.2	0.2
12	Pillularia americana	0.1	5
13	Calandrinia ciliata	0.1	
14	Senecio vulgaris	0.1	
15	Cerastium glomeratum	0.1	
16	Lactuca serriola	0.1	0.1
17	Trifolium depauperatum	0.1	0.2
18	Eremocarpus setigerus	0.1	0.3
19	Eleocharis macrostachya	1	0.3
20	Hordeum marinum		2
21	Plagiobothrys sp. micranthe		8
22	~~Crassula aquatica~~ duplicate		
23	Myosurus minimus		0.1
24	Bromus hordeaceus		1
25	Psilocarpus oregonus		0.5
26	Downingia pulchella		1
27	Ricardia quadrangularis		0.1
28	Mimulus tricolor		0.2
29	Epilobium cf. densiflorum		2
30	Vulpia bromoides		0.7
31	Veronica peregrina		0.1
32	Juncus uncialis		0.1
33	Phalaris lemmonii		0.1
34			
35			
36			
37			
38			
39			
40			
	TOTAL VEGETATIVE COVER	52.5	55.0
	BARE SOIL / ROCKS / COBBLES	1	45
	STANDING WATER	80	1
	DEAD THATCH / STRAW		
	ALGAE / ALGAL MATTING	1	
	BRYOPHYTES / LICHENS	0.1	
	ANIMAL DROPPINGS		0.5
	LITTER / GARBAGE / OTHER		
	TOTAL COVER ALL CATEGORIES	134.5	101.5

☐ SEE REVERSE FOR ADDITIONAL INFORMATION.

no fairy shrimp 3/6/95; terrestrial prior to 3/5 rains.

Carol W. Witham
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(916) 753-5872

Statement of Qualifications

- Extensive field experience in plant taxonomy and floristic survey methods. Familiar with many California and Nevada plant communities including their rare, threatened and endangered plants. Experience in avoidance/mitigation planning plus habitat restoration/recreation.

Related Experience - biological consulting; contracts since 1989 include

- **Rare, threatened and endangered plant surveys** for public and private concerns in a variety of habitats in Calaveras, Colusa, Contra Costa, El Dorado, Glenn, Lake, Lassen, Merced, Placer, Plumas, Sacramento, Shasta, Sierra, Solano, Tehama, Tuolumne and Yolo counties in California. Field mapping, mitigation and species conservation guidelines preparation.
- **Wetland delineations** for a large public utilities project in Alameda, Colusa, Contra Costa, Glenn, Merced, San Joaquin, Shasta, Solano, Stanislaus, Tehama and Yolo counties. Coordinate field personnel. Project included extensive mapping and plant community characterization for mitigation restoration efforts. Additional wetland delineation work for public and private concerns in Calaveras, El Dorado, Sacramento and Tuolumne counties.
- **Quantitative field sampling of vernal pool vegetation** for a public utilities project in Colusa, Glenn, Shasta, Solano and Tehama counties. Includes identification and mapping of rare plants, data analyses, mitigation/restoration plan recommendations, liaison with restoration subcontractors, construction monitoring, mitigation monitoring, mitigation parcel acquisition recommendations, plus supervision and training of all botanical support personnel. Numerous other vernal pool surveys and assessments in Butte, El Dorado, Lake, Merced, Placer, Sacramento, Solano and Sutter counties.
- **Quantitative field sampling of riparian vegetation** along Bishop and Pine creeks in Inyo County and Mill Creek in Mono County. Refine field sampling protocol. Supervise botanists and technical field support personnel. Mapping, data analyses, interpretation and reporting on a public utilities FERC mandated monitoring project.
- **Focused rare, threatened and endangered plant surveys** for *Astragalus tener* var. *tener* in Solano and Yolo counties; *Ivesia webberi* in Lassen, Plumas and Sierra counties in California and Douglas and Washoe counties in Nevada; *Gratiola heterosepala* in Glenn and Tehama counties.
- **Wetland management plans** for several wetland mitigation proposals. Review proposed wetland management or mitigation plans; provide alternative recommendations and propose monitoring guidelines.

Publications

- Witham, Carol W. (Ed.). 1989. *Jepson Prairie Preserve - field guide*. The Nature Conservancy, San Francisco, California. 67 pp.
- Witham, Carol W. 1993. The role of vernal pools in the 1992 mass dispersal of *Vanessa cardui* (Nymphalidae) with new larval hostplant records. *J. Res. Lepidoptera* 30(3-4):302-304.
- Witham, Carol and Greg Kareofelas. 1993. *Take a walk in the forest with us: a brief tour of the rain forest ecology of Hacienda Tropicale*. Centro Ecologico Hacienda Tropicale, Caracas, Venezuela. 34 pp.
- Witham, Carol and Greg Kareofelas. 1995. *On the Banks of the Cuyabeno: a brief tour of the rainforest ecology of Cuyabeno River Lodge*. Nuevo Mundo Expeditions, Quito, Ecuador. (*in press*)

Honors & Awards

- Outstanding Volunteer Service Award, The Nature Conservancy. 1989.
- Rare Plant Conservation Award, California Native Plant Society. 1992.

Other Experience - personal research and volunteer work

- Extensive distributional analyses and habitat studies of the rare, threatened and endangered plants of California; rare plant reporting and mapping for a wide variety of taxa throughout northern California and northern Nevada (1986-present).
- Discoverer of a new species of annual *Juncus* in Shasta County, California (1992).
- Rare plant monitoring for *Fritillaria liliaceae*, *Gratiola heterosepala*, *Tuctoria mucronata* and *Neostapfia colusana* in Solano County; *Cordylanthus palmatus* in Yolo County; *Fritillaria pluriflora* in Colusa County (1987-present).
- Habitat restoration: riparian woodland in Solano County (1987-1990); *Stipa pulchra* grassland in Solano County (1992-present); *Darlingtonia* fen in Plumas County (1989); vernal pools in Glenn, Solano, Shasta and Tehama counties (1992-present). Habitat creation: vernal pools and *Stipa cernua* grassland in Yolo County (1987-present).
- Chairperson, rare plant committee, Sacramento Valley Chapter, California Native Plant Society (1989-present). Coordinate all herbaria, library and CNDDB researcher, plus illustrators and other volunteers for upcoming rare plant information booklets (1992-present).
- Chairperson, plant watch committee, Sacramento Valley Chapter, California Native Plant Society (1989-present).
- Member, University of California Davis-The Nature Conservancy Joint Management Committee for Jepson Prairie Preserve (1988-1991).
- Member, rare plant scientific advisory committee (RPSAC), California Native Plant Society state-wide association (1995-present).
- Designer and trail guide author, self-guided interpretative trail at the TNC Jepson Prairie Preserve, Solano County (1991).
- Member, Committee to review Sacramento County Tree Preservation and Protection Ordinance (1991).
- Occasional field trip leader for California Native Plant Society, Northern Nevada Native Plant Society, The Nature Conservancy, and the Wildlands Program of the California Department of Fish and Game, and a variety of other conservation groups (1987-present).
- Volunteer docent, TNC Jepson Prairie Preserve, Solano County (1986-1990). Volunteer docent trainer, TNC Jepson Prairie Preserve, Solano County (1991-present).
- Participant, Annual Inter-Institutional Haybaling Expedition (1989-present); University of California Berkeley Museum of Paleontology-Far West Geoscience Foundation Joint Paleobotanical Field Expeditions (1990-present); Annual Xerces Society Butterfly Count on Mount Diablo (1990) and on Sonora Pass (1991).
- Guest field investigator, biological inventory and ecotourism assessment *Zona de Reserva Geobotanica, Crater del Volcan Pululahua*, Pichincha Province, Ecuador (Jan-Feb 1992); *Centro Ecologico Hacienda Tropicale*, Yaracuy State, Venezuela (Jan-Feb 1993); *Reserva de Produccion Faunistica Cuyabeno*, Sucumbios Province, Ecuador (Nov-Dec 1993).

References available upon request.

ROY A. WOODWARD
8605 Daimler Way
Sacramento, CA 95828
(916) 682-4137

EDUCATION:

Ph.D. in Botany, University of California, Davis	1986
M.S. in Range Science, Brigham Young University	1981
B.S. in Range Science, Brigham Young University	1979

EXPERIENCE:

1993 - Present: Science Specialist for Bechtel Corporation Environmental Technologies group in San Francisco. Serve as lead biological consultant for Bechtel projects worldwide.

- Completed several Ecological Risk Assessments and oversaw field sampling programs for CERCLA/RCRA sites and military base closures in Idaho and California.
- Oversaw biological subcontractors for 300 mile pipeline project EIR/EIS in California.
- Served as Biological Resources Supervisor for the installation of the PGT-PG&E Expansion Pipeline Project which runs 1,100 miles from northern Idaho to central California. Oversaw biological subcontractors and was responsible for coordination with government agencies and local citizen groups for rare plant, wildlife, and restoration and sediment control issues.
- Performed environmental assessments for Maheshwar hydroelectric project in central India and Teesta hydroelectric project in Himalaya mountains, India.
- Performed biological assessments for Moffett Field wind tunnel in California, Global Transpark airport facility in North Carolina, Shell-Martinez refinery in California, and San Francisco Energy Company's co-gen plant in California
- Designed and/or installed mitigation/revegetation plans for Space Launch Complex Project at Vandenberg Air Force Base in California, Shell-Martinez refinery in California, SDG&E natural gas pipeline crossing of the Otay River in California, Reynolds Metals project in New York, and for a natural gas field and pipeline in south Texas.

Senior Wildlife Biologist - Supervisor, California Department of Fish and Game

Dr. Woodward served as Program Coordinator for the Nongame Bird and Mammal Program. This program is responsible for over 600 species of wildlife including all state or federally listed species. He was responsible for budgeting and administration for a one-million-dollar plus annual program, liaison with other agencies including serving on national wildlife coordination committees, and department lead person to develop complex wildlife conservation/management plans for public lands. Served as wildlife representative on private lands stewardship committee and as department contact for several citizen advisory groups, including environmental groups and development interests.

Senior State Park Resource Ecologist, California Department of Parks and Recreation

Dr. Woodward supervised five ecologists responsible for development of State Park General Plans. He coordinated statewide Resource Management Projects and Stewardship Projects dealing with vegetation management and general ecology in the State Park System. He had lead responsibility to reconcile biological plans with cultural issues and served as prime citizen contact at public meetings.

Associate State Park Resource Ecologist, California Department of Parks and Recreation

Dr. Woodward was responsible for the development of soil loss and erosion control standards for all off-highway vehicle areas in California. He chaired a multi-agency committee and secured citizen support for all biological issues. He also administered development of a Geographical Information System used to track revegetation projects and prepared revegetation plans and carried out restoration projects for beach, desert, shrubland, and forest types.

Environmental Resource Planner, U.S. Army Corps of Engineers, Sacramento District

Dr. Woodward conducted botanical surveys and resource inventory reviews for various dam and levee projects and prepared restoration and monitoring plans; assessed the impact of military vehicle maneuvers on Nevada desert vegetation; and sampled species composition and successional establishment of restored vegetation on new islands formed from dredge spoils in the Sacramento River Delta.

Post-Doctoral Researcher, Environmental Horticulture Department, UC Davis

Dr. Woodward conducted research of cold and salt tolerance of eucalyptus and other hardwood species to identify superior trees that can be vegetatively propagated and planted in biomass plantations in California. He established over a dozen trial plantations throughout California.

Post-Doctoral Researcher, Botany Department, UC Davis

Dr. Woodward conducted a rehabilitation and vegetation survey of the Tule Elk State Reserve for the California Department of Parks and Recreation. He also conducted vegetation and meadow restoration surveys at Calaveras Big Trees, Grover Hot Springs, and Washoe Meadows State Parks for the California Department of Parks and Recreation.

Research Assistant, Botany Department, UC Davis

Dr. Woodward conducted a range vegetation survey in the arid Owens Valley, California. This project was sponsored by NASA and involved identifying and quantifying vegetative cover and ecophysiology, assessing plant phenology, and measuring plant spectral characteristics in order to estimate biome production and species composition using advanced remote sensing techniques.

Forest Technician, California Department of Forestry

Dr. Woodward conducted research involving post-harvest conditions in coast redwood forests, including baseline descriptions of natural vegetation, amounts and uses of harvest residue, residual stand growth, and plantation success. He prepared reforestation plans for steep, highly erosive areas.

Research Assistant, Range Science Department, Brigham Young University

This research for Dr. Woodward's M.S. examined the mechanism employed by several arid rangeland plant species to obtain soil nutrients on difficult to revegetate disturbed sites.

Range Technician, U.S. Forest Service Experiment Station

This project of the Shrub Sciences Laboratory at Provo, Utah involved revegetation of oil shale and coal mine spoils in the Great Basin. Dr. Woodward performed extensive greenhouse work, field planting and maintenance, and data collection and analysis of trial plantings on disturbed arid rangeland sites in Utah and Colorado.

Botanist, Private Consultant

Dr. Woodward served as an environmental consultant in Amador County, California for several gold, gravel, clay and lignite mines. He conducted pre-mining biological surveys, assisted with mine permitting

and EIR development, and carried out post-mining restoration and monitoring for over two-thousand acres of forest, grassland, and wetland habitats.

Botanist, Private Consultant

Dr. Woodward conducted a survey of restored rangeland sites in the Elk Hills Naval Petroleum Reserve. The survey included qualitative and quantitative sampling of revegetated oil drilling sites and roads. He sampled over one-hundred separate sites and reported the results, including recommendations for future revegetation efforts.

PROFESSIONAL ACTIVITIES:

Dr. Woodward has previously served as Secretary and President of the Sacramento Chapter of the Soil and Water Conservation Society. He is an Eagle Scout and an active leader in Boy Scouting.

Professional Licenses & Societies:
Certified Professional Erosion and Sediment Control Specialist #434
California Native Plant Society (Serves on Vegetation Classification Committee.)
Soil and Water Conservation Society
Society for Ecological Restoration

Language Skills:
English - excellent
Spanish - fair
Russian - fair

Photo 1. March 1995. Brush piles near Castle Dam.

Photo 2. March 1995. Vernal pools upstream of Castle Dam.

Photo 3. June 1995. Castle Dam and Reservoir with brush piles in background.

Photo 4. June 1995. Castle Dam and inundated willow and cottonwood trees in Castle Dam Reservoir.

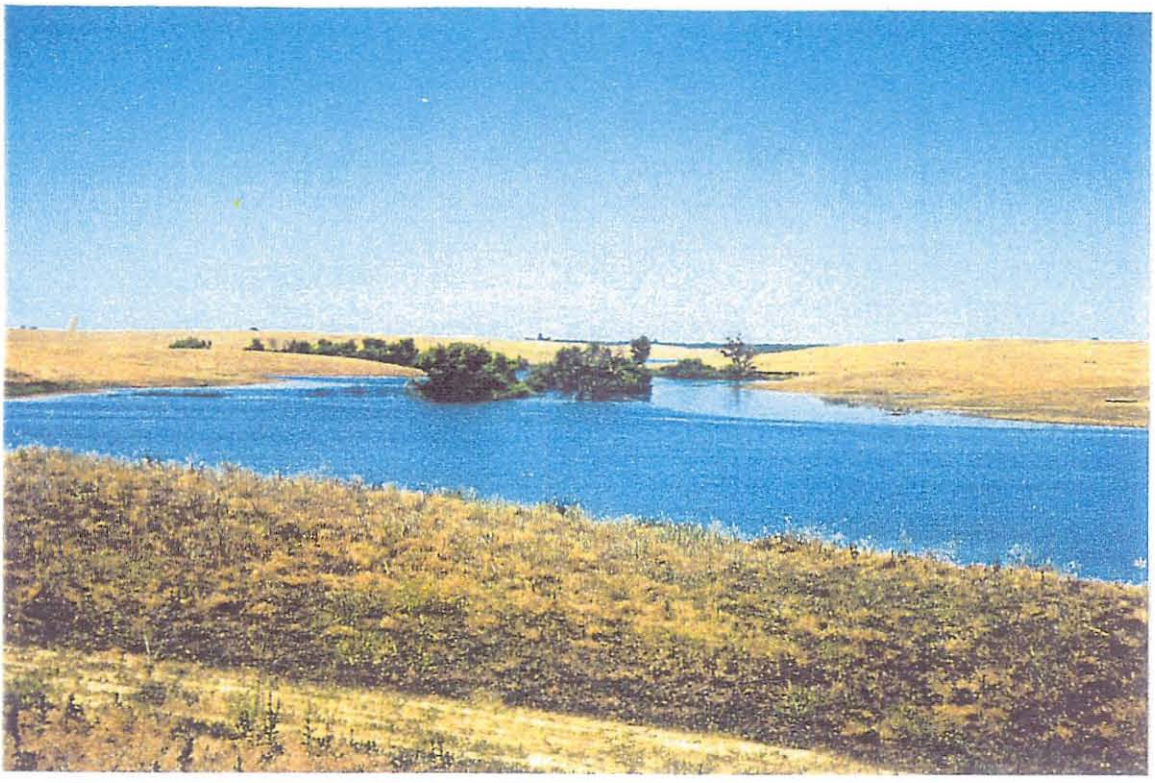


Photo 5. June 1995. Castle Dam Reservoir with inundated riparian trees.

Photo 6. June 1995. Inundated willow and cottonwood trees in Castle Dam Reservoir.

Photo 7. June 1995. New willow growth on edge of Castle Dam Reservoir.

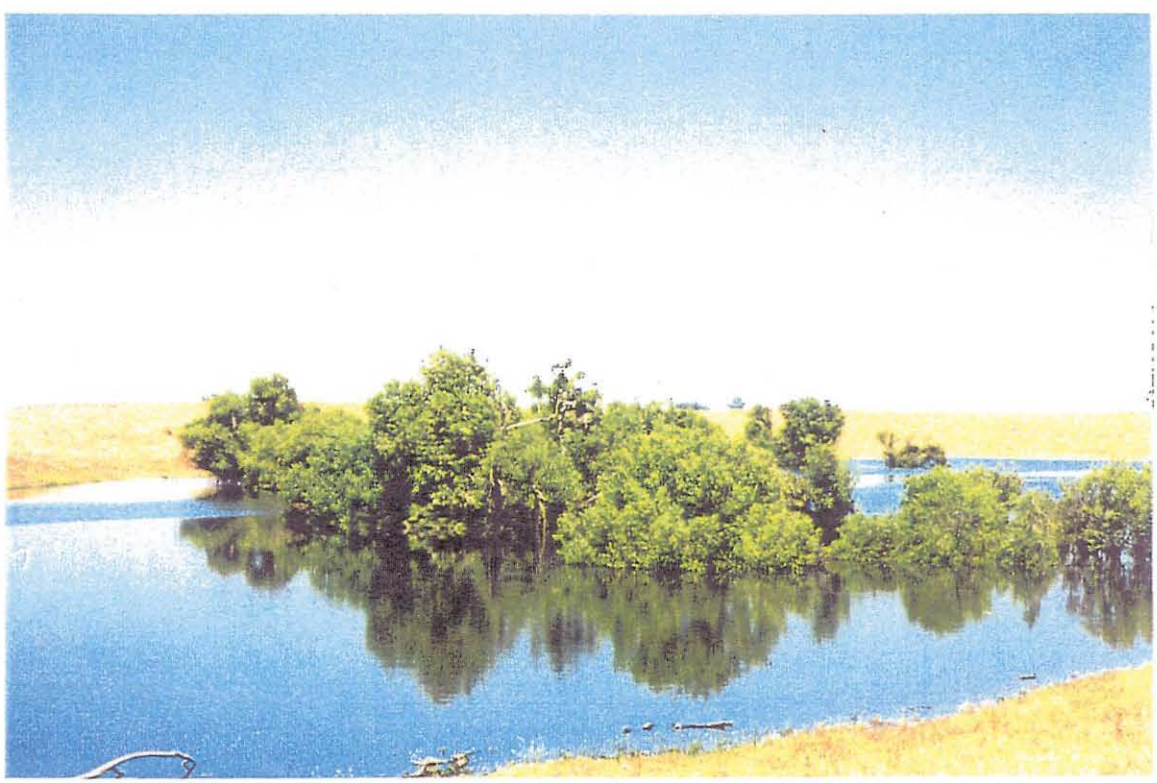
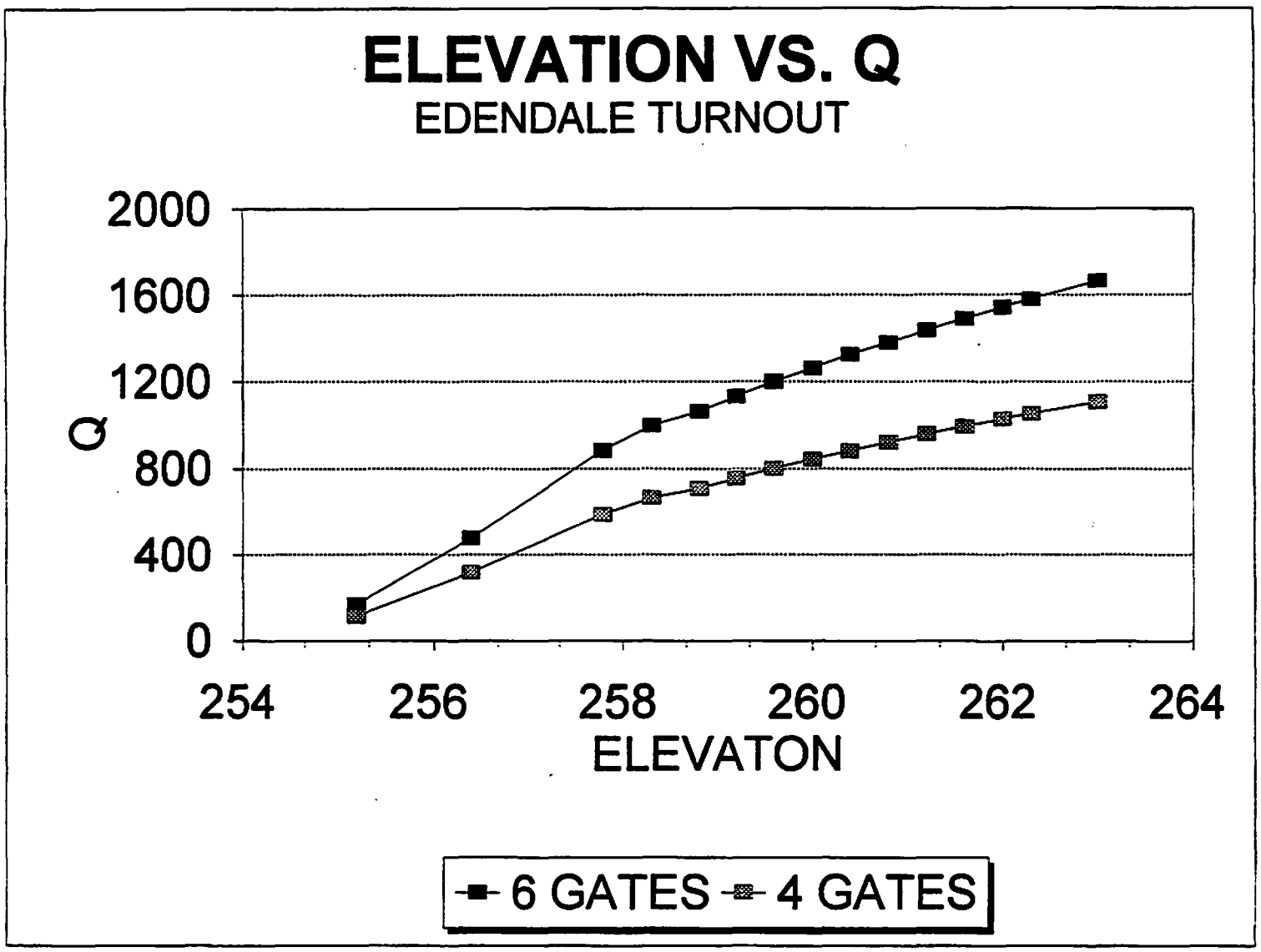


Photo 8. June 1995. Great blue heron and Great egret rookery in tree in center of photo. At least 6 nests are in this tree and chicks were present when the photo was taken.

EXHIBIT G
HYDRAULIC RATING CURVES


ELEVATION VS. Q
EDENDALE TURNOUT
2000
1600
1200
800
400
0
Q
254
256
258
260
262
264
ELEVATON
6 GATES
4 GATES

Castle Dam

Outlet Rating with Bulkhead Closed

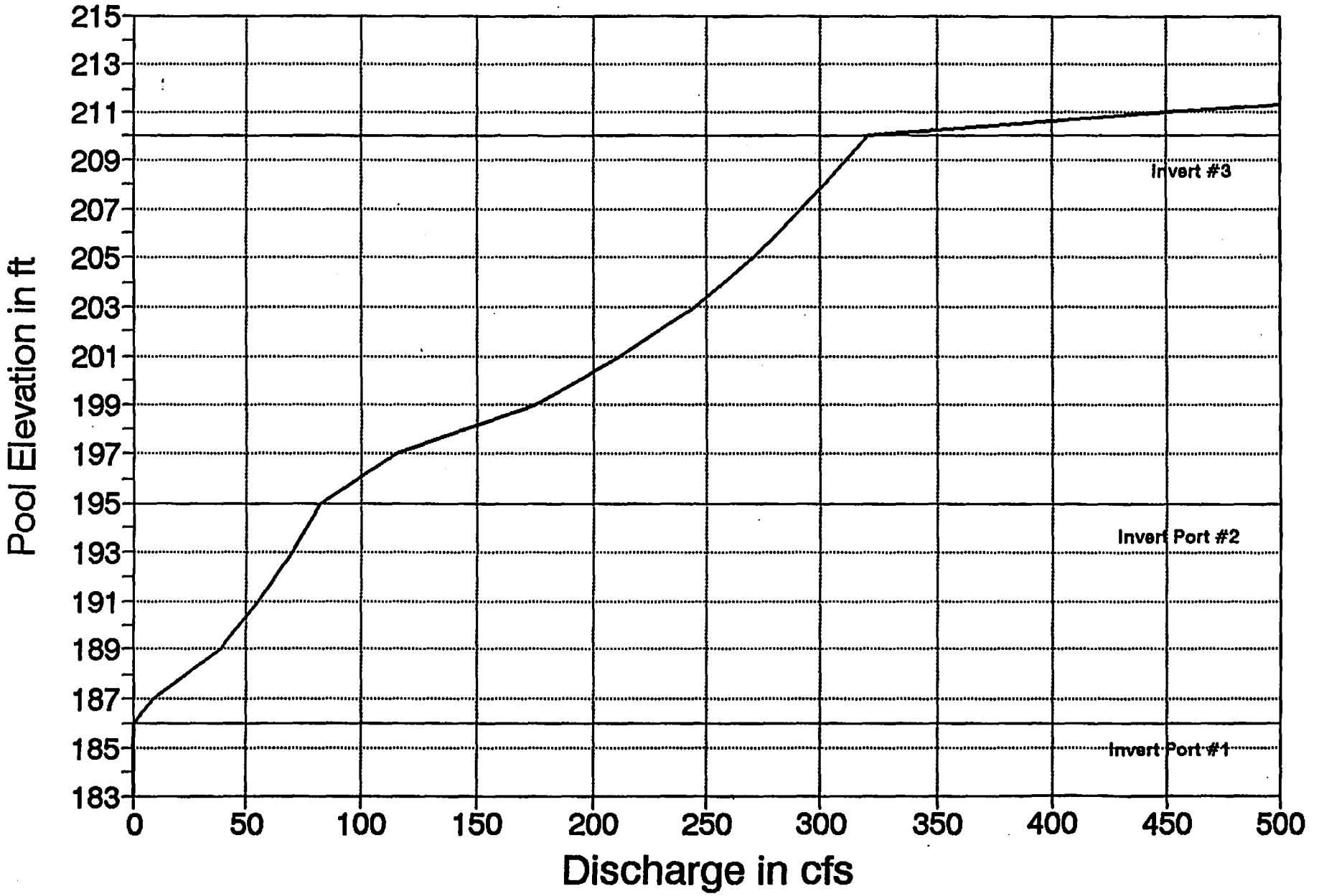
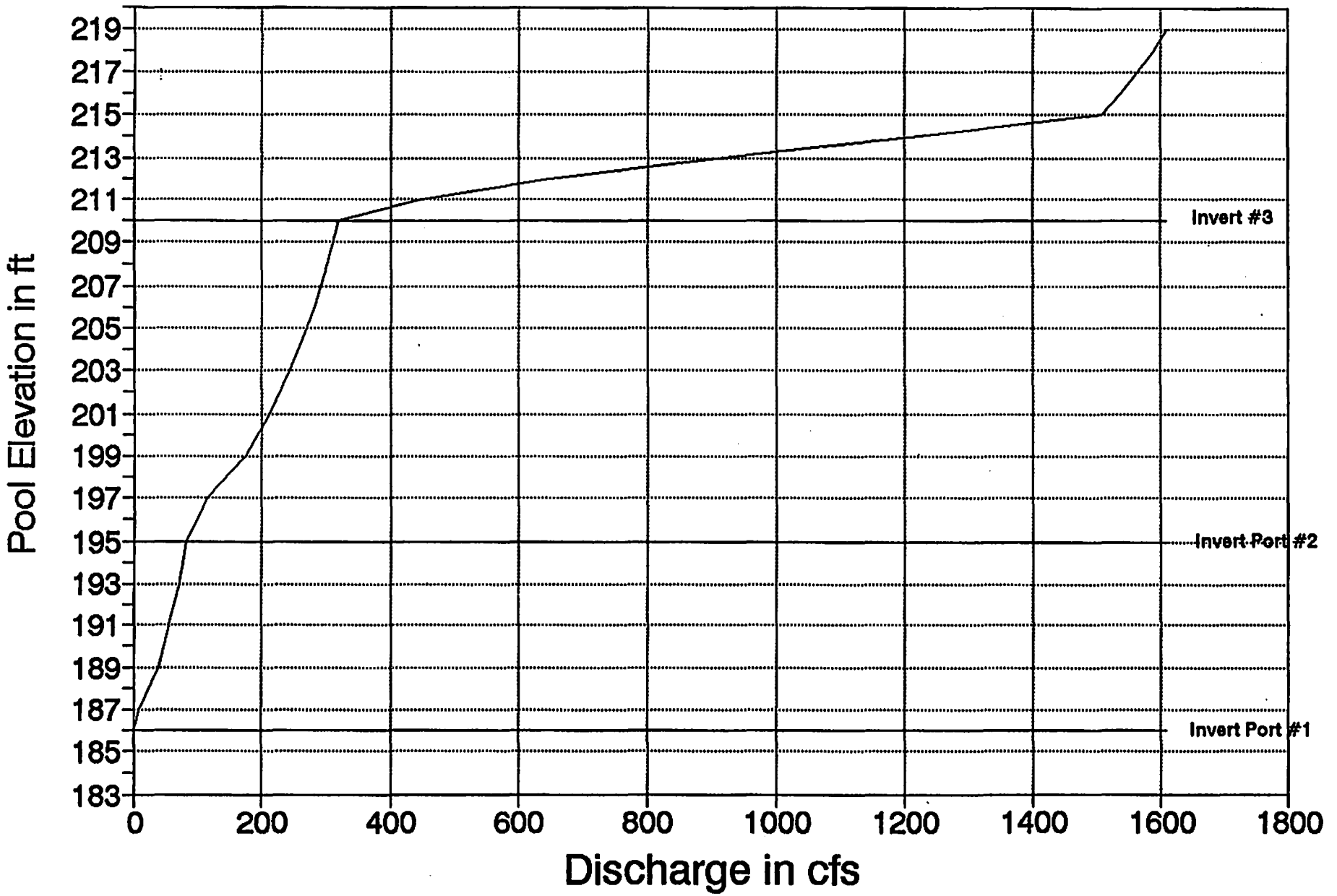


Exhibit G
2

Castle Dam

Outlet Rating with Bulkhead Closed



Castle Dam, Merced
Rating of Irrigation Intake

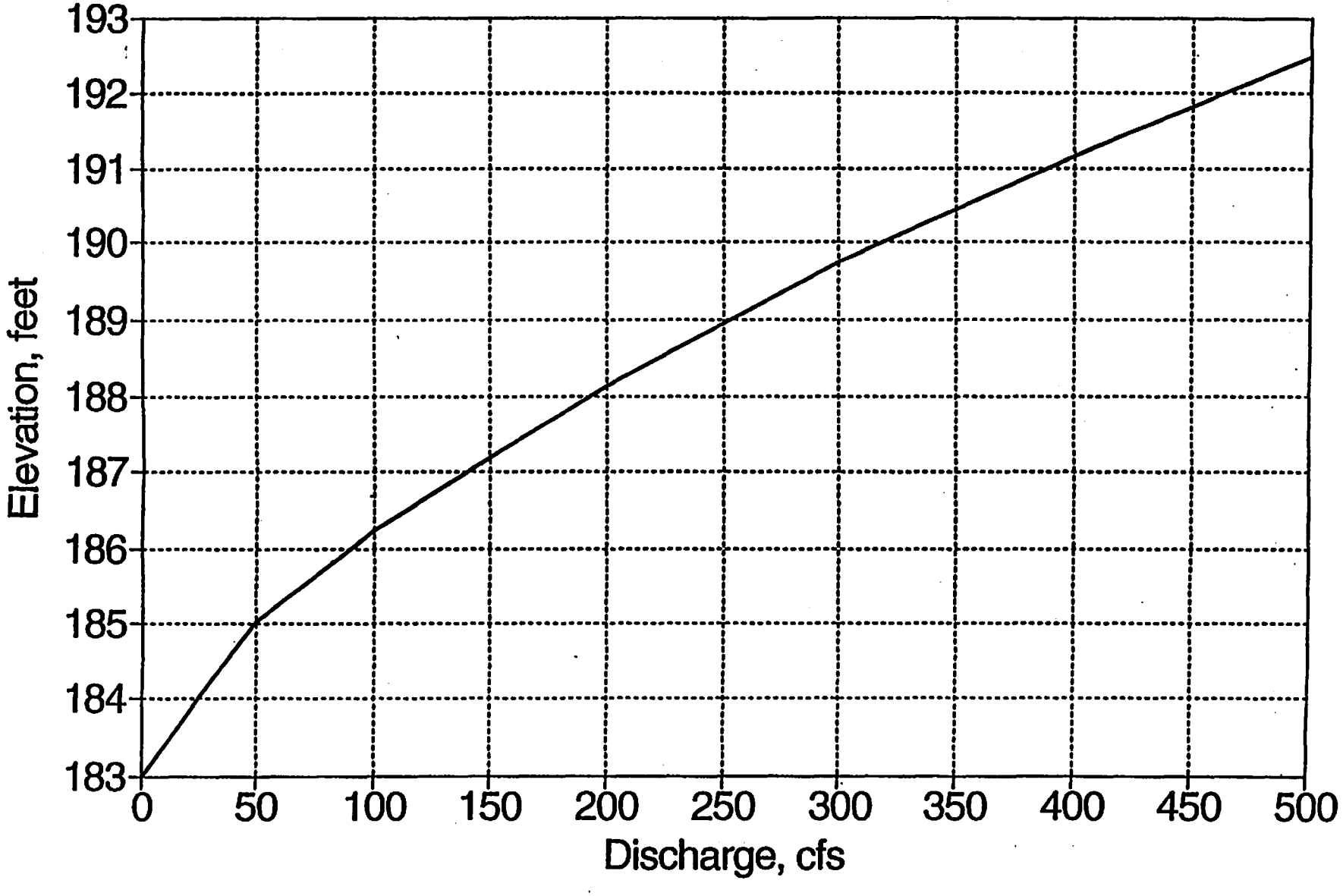


Exhibit G
6

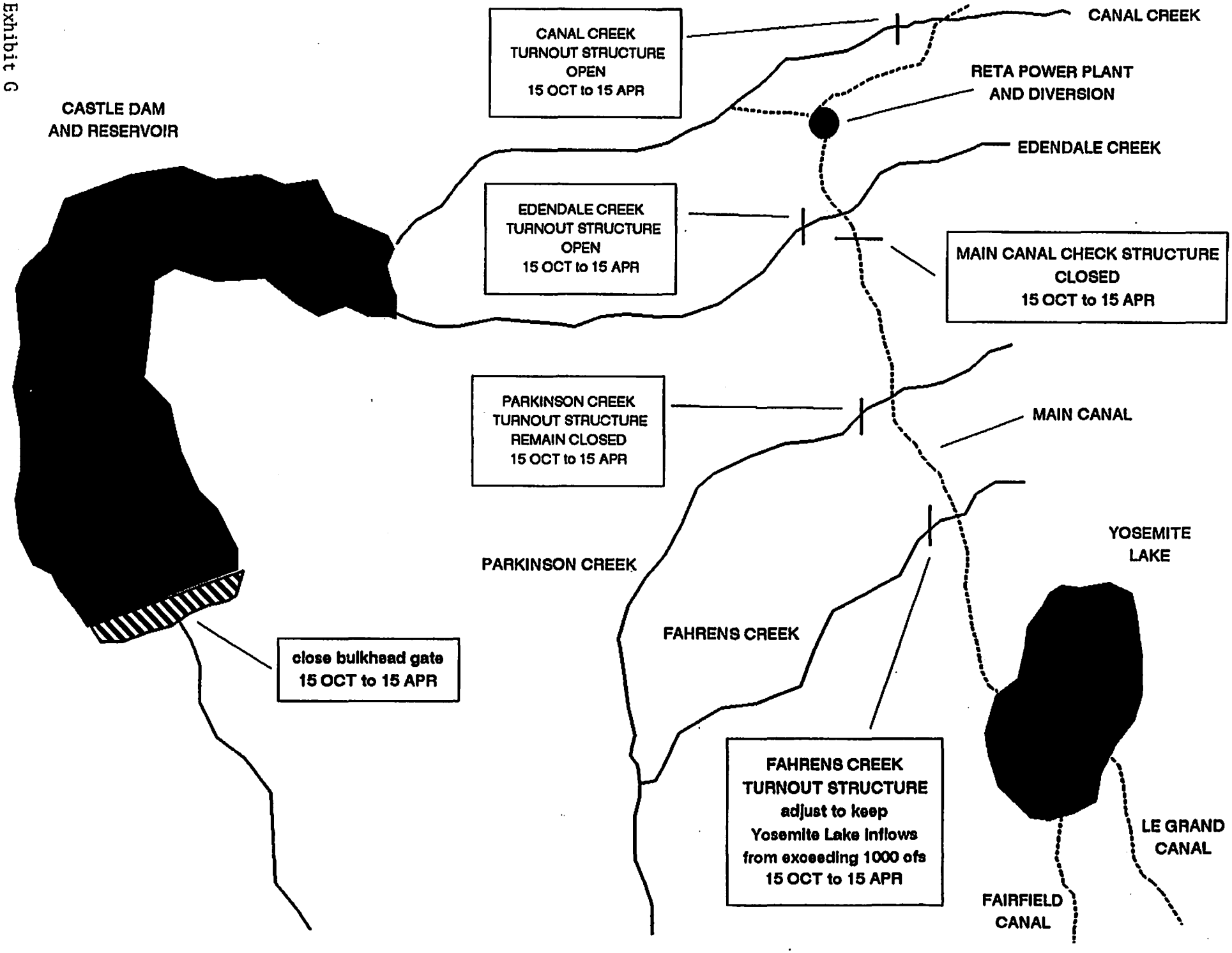

CANAL CREEK
CANAL CREEK TURNOUT STRUCTURE OPEN 15 OCT to 15 APR
RETA POWER PLANT AND DIVERSION
CASTLE DAM AND RESERVOIR
EDENDALE CREEK
EDENDALE CREEK TURNOUT STRUCTURE OPEN 15 OCT to 15 APR
MAIN CANAL CHECK STRUCTURE CLOSED 15 OCT to 15 APR
PARKINSON CREEK TURNOUT STRUCTURE REMAIN CLOSED 15 OCT to 15 APR
MAIN CANAL
YOSEMITE LAKE
PARKINSON CREEK
FAHRENS CREEK
close bulkhead gate 15 OCT to 15 APR
FAHRENS CREEK TURNOUT STRUCTURE adjust to keep Yosemite Lake inflows from exceeding 1000 cfs 15 OCT to 15 APR
LE GRAND CANAL
FAIRFIELD CANAL

EXHIBIT H
GATE MAINTENANCE

119

SHOP DRAWING FILE

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE
(Read instructions on the reverse side prior to initiating this form)

DATE: 25 July 91

TRANSMITTAL NO. 029

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO: DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
FRESNO RESIDENT OFFICE
P.O. BOX 25280
FRESNO, CA 93729-5280

FROM: FORD CONSTRUCTION COMPANY, INC.
639 E. LOCKEFORD STREET
LODI, CA 95240

CONTRACT NO: DACW05-91-C-0055

CHECK ONE:
☒ THIS IS A NEW TRANSMITTAL
☐ THIS IS A RESUBMITTAL OF TRANSMITTAL 017

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number/etc.)	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT: SPEC. PARA. NO. e.	CONTRACT REFERENCE DOCUMENT: DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION (See Instruction No. 6) h.	FOR C E USE CODE i.
	Section 15050 Sluce Gate Rodney Hunt Sub-Cont							
010016	Specifications	Letter	6		M-1			Ex
010002	Sluce Gate	DWG.	6	7	M-1			A
010005	Sluce Gate (Special)	DWG.	6	7	M-1			
010001	Thimble	DWG.	6	5	M-1			
010003	Stem Guide	DWG.	6	8	M-1			
010006	Split Stem Guide.	DWG.	6	8	M-1			
010007	Hoist Bracket	DWG.	6	10	M-1			
010008	Floor Stop Collar	DWG.	6	10	M-1			
010009	Floor Mounted Stem Guide	DWG.	6	10	M-1			
010010	Hoist	DWG.	6	10	M-1			
010011	Pinion Locking Device	DWG.	6	10	M-1			

REMARKS

* See a Hached.

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

John Bates
NAME AND SIGNATURE OF CONTRACTOR

Exhibit H
2 of 26

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read Instructions on the reverse side prior to initiating this form)

DATE: 25 July 91

TRANSMITTAL NO.: 029

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO: DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
FRESNO RESIDENT OFFICE
P.O. BOX 25280
FRESNO, CA 93729-5280

FROM: FORD CONSTRUCTION COMPANY, INC.
639 E. LOCKEFORD STREET
LODI, CA 95240

CONTRACT NO: DACW05-91-C-0055

CHECK ONE:
☐ THIS IS A NEW TRANSMITTAL
☒ THIS IS A RESUBMITTAL OF TRANSMITTAL 017

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number/etc.) b.	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See Instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT: SPEC. PARA. NO. e.	DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION (See Instruction No. 6) h.	FOR C E USE CODE i.
010012	Clear Stem Cover	DWG	6	8	M-1			A
010013	Epoxy Coating	Spec.	6	2	M-1			B
010014	Engineering Calculations	Letter	6	2	M-1			A
010015	Material Spec.	Letter	6	1	M-1			A

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

John Bates
NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY
D.R. DEL PORTO
Chief, Const. Quality Assurance Section
Authorized Representative of the Contracting Officer

DATE: AUG 19 1991

ENG FORM 4025, Aug 89 (ER 415-1-10) EDITION OF OCT 84 IS OBSOLETE. SHEET 2 OF 2

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE: 29 August 91

TRANSMITTAL NO.: 031

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO: DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
FRESNO RESIDENT OFFICE
P.O. BOX 25280
FRESNO, CA 93729-5280

FROM: FORD CONSTRUCTION COMPANY, INC.
639 E. LOCKEFORD STREET
LODI, CA 95240

CONTRACT NO: DACW05-91-C-0055

CHECK ONE:
☐ THIS IS A NEW TRANSMITTAL
☒ THIS IS A RESUBMITTAL OF TRANSMITTAL 029

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number/etc.)	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT: SPEC. PARA. NO. e.	CONTRACT REFERENCE DOCUMENT: DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION (See instruction No. 6) h.	FOR C E USE CODE i.
	Section 15050 Sluce Gate Rodney Hunt Sub-Cont							
010016	Specifications	Letter	6		M-1			G X

SEND DRAWING FILE

RECEIVED
SEP 0 3 1991
FRESNO RESIDENT OFFICE

REMARKS: * See attached sheet.

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by item No.)

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY
D.R. DEL PORTO
Chief, Const. Quality Assurance Section
Authorized Representative of the Contracting Officer

DATE: OCT 1 1991

ENG FORM 4025, Aug 89 (ER 415-1-10) EDITION OF OCT 84 IS OBSOLETE. SHEET ____ OF ____ (Proponent: CEMP-CE)

Exhibit H 74 of 75

PAGE

REASONS FOR REJECTING CONTRACTOR TRANSMITTALS

PROJECT TITLE: Castle Dam & Reservoir

LOCATION: Merced County | CONTRACT NO.: DACW05-91-C-0[illegible] | TRANSMITTAL NO.: 3

ITEM NO.	CONTRACT REFERENCE DRAWING NO./SPEC PARA	CONTRACT REQUIREMENT	TRANSMITTAL DATA SHOW
16	15050 - 11.3	(1) Unstressed sample	Not Addressed; Submi[illegible] says ASTM D1149 [illegible]
			says bent i.e. stress[illegible] sample is to be u[illegible]
		(2) 70 hours	Not Addressed; ASTM
			D1149 doesn't specify
		(3) 104°F	Not Addressed; ASTM[illegible]
			says standard is 104°F allows other
		(4) No visible cracking	ASTM D1149, but no
			results stated
	-11.3.2	(5) <2% volume increase	Not Addressed; Submittal says ASTM D-471 but
			no results stated
		(6) Distilled water	Not addressed; ASTM
			D471 allows other liquid
		(7) 73.4°F (= 23°C)	Not addressed; ASTM
			D-471 allows other temps
		(8) 70 hours	Not addressed; ASTM
			D-471 allows other immersion
			periods

Exhibit H

SPK FORM 454
1 JUN 84

122

RODNEY HUNT COMPANY

ESTABLISHED 1840

RODNEY HUNT

ITEM # 010016

ORANGE, MASSACHUSETTS, 01364, U.S.A.

July 19, 1991

GME 16 Aug 91

Ford Construction Company, Inc.
605 Bellveau Road
Suite 253
Atwater, California 95301

DISAPPROVED
THIS SUBMITTAL DOES NOT COMPLY WITH CONTRACT REQUIREMENTS. SEE ACOM 4025 AND/OR ... FOR THIS FORM, AS APPLICABLE, FOR DISAPPROVAL REASONS. RESUBMISSION REQUIRED.

Attention: Mr. Martin Schumacker
Mr. John Bates

Reference: Your Project #91-03
Rodney Hunt Shop Order #14077-2

Project: Castle Dam - Canal Creek, California

Gentlemen:

Enclosed you will find eight copies of the following revised drawings for your approval:

Item #1 Castle Dam Inlet (1 Unit)

E-41419	Inst:	90" x 114" Sluice Gate, Series Hy-Q 140
C-21339	Assy:	90" x 114" Sluice Gate, Series Hy-Q 140
E-41365	Detail:	87" x 114" Wall Thimble, F Section, 18" Deep
F-12412-07	Detail:	Internal Stem Guide
E-18686-03	Assy:	Wall Mounted Stem Guide
F-11050-09	Detail:	Lower Stop Collar
E-15424-12	Assy:	Wall Bracket
E-4333-08	Assy:	Floor Mounted Stem Guide
E-26372	Assy:	S-6012 Hoist
F-10932	Detail:	Pin and Locking Device for an F-6012 Hoist
F-9323-44	Assy:	Stem Cover
14077-2	-	Rodney Hunt Material Specification Sheet
Catalog Cut:	-	Amerlock 400
Catalog Cut:	-	Amercoat 450HS
-	-	Calculation Sheet
WCE82-4	-	Rodney Hunt Instruction Manuals (2 Copies)

Please return one copy of each drawing marked approved or with your comments as soon as possible. Please review the paint and materials stated on our material specification sheet.

46 MILL STREET • TEL 508-544-2511 • FAX 508-544-7204

The following comments and clarifications are a direct response to the comments listed on their attach sheet dated 6/3/91 by the reviewer Mr. Gene Ernst:

a). Drawing #C-21339, 90" x 114" sluice gate, series Hy-Q 140, is designed for seating and unseating heads in excess of the design head specified on sheet M-1, paragraph 2.

b). The frame will be designed and manufactured per paragraph 4 as specified.

c). As stated on the Rodney Hunt Company's material specification sheet #14077-2, the wall thimble is made of cast iron ASTM A126 CL B.

d). Drawing C-21339, assembly, 90" x 114" sluice gate, series Hy-Q 140, indicates that more than 2/3 of the disc is contained in the guides when the disc is in the full open position. The bronze wedges on the disc are fully adjustable.

e). The sluice gate materials are stated on Rodney Hunt's material specification sheet #14077-2. The disc, frame and guides are cast iron ASTM A126 CL B. The seat facing is bronze ASTM B21 CA 464. The sluice gate disc has six top wedges and six side wedges on each side.

f). The stem material, as stated on the material specification sheet, #14077-2 is stainless steel ASTM A276 304, COND. A. The thrust nut and the stem coupling material is Bronze ASTM B584 CA865. The stem guide will be cast iron ASTM A126 CL B with bronze bushing SAE 660 193.

g). The material specification sheet has been revised to have all anchor bolts, studs and fasteners to be stainless steel ASTM ~~A276 304 COND. A~~ F 593 8S and the stainless steel nuts to be ASTM F 594 304, COND. A.

h). The bevel gear material is a hardened steel SAE 414.

i). We are enclosing for additional information, a calculation sheet stating the maximum crank effort is 35.4 lbs. to break the sluice gate out of the wedges and the maximum running load is 27.9 lbs. on the crank.

j). Paragraph 10 specifies a minimum 4 to 1 gear ratio. We have proposed a two speed hoist providing a 4 to 1 ratio and a 12 to 1 ratio. The maximum operating loads require use of a 12 to 1 ratio pinion shaft. On the 12 to 1 pinion, an effect of 36 pounds is required. This meets the 40 lb. effort specification. Paragraph 10 also specifies the crank rpm

RODNEY HUNT

and gate speed. At 16 turns per minute of the crank on the 12 to 1 pinion, the gate will move .53" per minute. At 16 turns per minute, the crank on the 4 to 1 pinion, the gate will move 1.6" per minute but will require an effort of 108 lb. crank effort which will initiate gate move. This gate is designed to be broken out of the wedges with the 12 to 1 pinion shaft. Most of the gate has been broken out of the wedges. It should be completely open with a 4 to 1 pinon shaft.

k). This S-6012 hoist is furnished with a mechanical shaft seals and is completely filled with grease to prevent moisture from entering the sealed housing and can withstand limited emersion.

l). The S-6012 hoist is furnished with directional arrows and open and close markers around the input shafts.

m). We are enclosing drawing F-10932, detail, titled pinion locking device. This covers each of the hoist stub shafts so they can not be operated by any unauthorized person.

comply w/ requirements of 11.3 thru 11.3.2

n). The resilient seal for the flush bottom gate is neoprene D 2000 which meets your specification section 11.1 titled, Resilient Seals. The seal is mounted on the bottom of the disc by the means of a retainer bar. This leaves the frame invert flush with the bottom of the channel.

o). Rodney Hunt Company's 90" x 114" sluice gate, series Hy-Q 140, is furnished the same as sheet M-1, detail B. The only difference is that the stop bar that we are furnishing is stainless steel ASTM A276 304, COND. A, instead of cast iron.

p). ~~We are furnishing our S-6012 hoist with a standard mechanical dial position indicator. At the time of bid, we did not quote on handar increment shaft encoder and we do not usually quote this type of equipment. The specification 0245-3.2.7.5 (amend 0003), was not received here until January 28, 1991. Our original quote was sent to you on January 23, 1991.~~

FCCI to furnish

We have revised our installation drawing with the use of a adjustable stop collar as required by paragraph 10.

Please note that we have revised all Rodney Hunt title blocks and removed the statement that is inconsistently a contract clause 74D.

Encoder shall be of specified mfgr. — not Rodney Hunt.

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RODNEY HUNT

If I can be of any further assistance, please feel free to contact us.

Very truly yours,

Peter V. West

Peter V. West
Design Engineer

PVW:ged
Enclosures
/WP/C/PVW/FORD2

cc: J-M Squared & Associates, Inc.

ITEM # 010014

ITEM NO. : 1

LOCATION : CASTLE DAM - INLET WORK

GATE SIZE: 7.5' x 9.5' DISC WEIGHT: 9000 LBS.

OP. HEAD: 5' FT. HOIST: S-6012 W/ 18" CRANK

STEM DIA.: 3.00" (MINOR DIA.: 2.58")

STEM WEIGHT: 468 LBS. 2.5 T.P.I.

THRUST (OPEN) = WATERLOAD + DISC & STEM WEIGHT + WEDGING FORCE

$= [(65.82')(5')(62.4)(.35)] + (9000 + 688) + (4500) = 21,376$ LBS.

THRUST AFTER WEDGE PULLOUT = WATERLOAD DISC & STEM WEIGHT

$= 21,376 - 4500 = 16,875$ LBS.

EMPIRICAL HOIST OUTPUT @ 40 LBS. CRANK EFFORT S-6012 W/ 18" CRANK = 24,120 LBS.

MAX. REQ'D. CRANK EFFORT $= \frac{(21,376)}{(24,120)} 40 = 35.4$ LBS

CRANK EFFORT AFTER PULLOUT $= \frac{(16,875)}{(24,120)} 40 = 27.9$ LBS

COLUMN BUCKLING LIMITS (THREADED STEM SECTIONS)

STEM DESIGN LOAD = OPER. OUTPUT @ 80 LBS. CRANK S-6012 EFFORT = 48,240 LBS.

EULER'S MAXIMUM LENGTH =

$\sqrt{2(\pi)^2(25 \times 10^6)[1/64\,\pi(2.58)^4] \div (48,240)} = 157''$ OR $13'-1$

MAX. SLENDERNESS RATIO L/R = MAX. LENGTH = $200(.25)(2.58) = 129''$ OR $10'-9''$

MAX. THREADED LENGTH USED FOR ITEM 1 = $\boxed{10'-9''}$

COLUMN BUCKLING LIMITS (PLAIN STEM SECTIONS)

EULER'S MAXIMUM LENGTH = 213"

SLENDERNESS RATIO MAX. LENGTH 150" or 12'-6"

MAX. PLAIN LENGTH USED FOR ITEM 1 = $\boxed{12'-6''}$

CODE "A"
APPROVED AS SUBMITTED

CORPS OF ENGINEERS, U.S. ARMY
SACRAMENTO DISTRICT

Certified for approval by Gene R. Ernst
Date: 08-16-91

Spillage - Eliminate all sources of ignition. Use absorbent cleanup materials. Place in separate, closed, metal container.

Storage and disposal - Material sensitive to moisture. Keep container tightly closed and upright when not in use to prevent leakage and moisture absorption. Store in cool, well ventilated area at 40 to 100°F (4 to 38°C). Dispose of in separate, closed, metal container in accordance with all applicable regulations.

CAUTION - IMPROPER USE AND HANDLING OF THIS PRODUCT CAN BE HAZARDOUS TO HEALTH AND CAUSE FIRE OR EXPLOSION.

DO NOT USE THIS PRODUCT WITHOUT FIRST TAKING ALL APPROPRIATE SAFETY MEASURES TO PREVENT PROPERTY DAMAGE AND INJURIES. THESE MEASURES MAY INCLUDE, WITHOUT LIMITATION: IMPLEMENTATION OF PROPER VENTILATION, USE OF PROPER LAMPS, WEARING OF PROPER PROTECTIVE CLOTHING AND MASKS, TENTING AND PROPER SEPARATION OF APPLICATION AREAS. CONSULT YOUR SUPERVISOR. PROPER VENTILATION AND PROTECTIVE MEASURES MUST BE PROVIDED DURING APPLICATION AND DRYING TO KEEP SOLVENT VAPOR CONCENTRATIONS WITHIN SAFE LIMITS AND TO PROTECT AGAINST TOXIC HAZARDS. NECESSARY SAFETY EQUIPMENT MUST BE USED AND VENTILATION REQUIREMENTS CAREFULLY OBSERVED, ESPECIALLY IN CONFINED OR ENCLOSED SPACES, SUCH AS TANK INTERIORS AND BUILDINGS.

THIS PRODUCT IS TO BE USED BY THOSE KNOWLEDGABLE ABOUT PROPER APPLICATION METHODS. AMERON MAKES NO RECOMMENDATION ABOUT THE TYPES OF SAFETY MEASURES THAT MAY NEED TO BE ADOPTED BECAUSE THESE DEPEND ON APPLICATION ENVIRONMENT AND SPACE, OF WHICH AMERON IS UNAWARE AND OVER WHICH IT HAS NO CONTROL.

IF YOU DO NOT FULLY UNDERSTAND THESE WARNINGS AND INSTRUCTIONS OR IF YOU CANNOT STRICTLY COMPLY WITH THEM, DO NOT USE THE PRODUCT.

NOTE: Consult Code of Federal Regulations Title 29, Labor, parts 1919, 1915 and 1916 concerning occupational safety and health standards and regulations, as well as any other applicable federal, state and local regulations on safe practices in coating operations.

Notice: This product is for industrial use only.

Warranty

Ameron warrants its products to be free from defects in material and workmanship. Ameron's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Ameron's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the nonconforming products. Any claim under this Warranty must be made by Buyer to Ameron in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the delivery date, whichever is earlier. Buyer's failure to notify Ameron of such nonconformance as required herein shall bar Buyer from recovery under this Warranty.

Ameron makes no other warranties concerning the product. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Ameron be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of the products made by Ameron, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

Limitation of Liability

Ameron's liability on any claim of any kind, including claims based upon Ameron's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or part thereof which give rise to the claim. In no event shall Ameron be liable for consequential or incidental damages.

201 North Berry Street
Brea, California 92622-1020

J. F. Kennedylaan 7
4191 MZ Geldermalsen, The Netherlands

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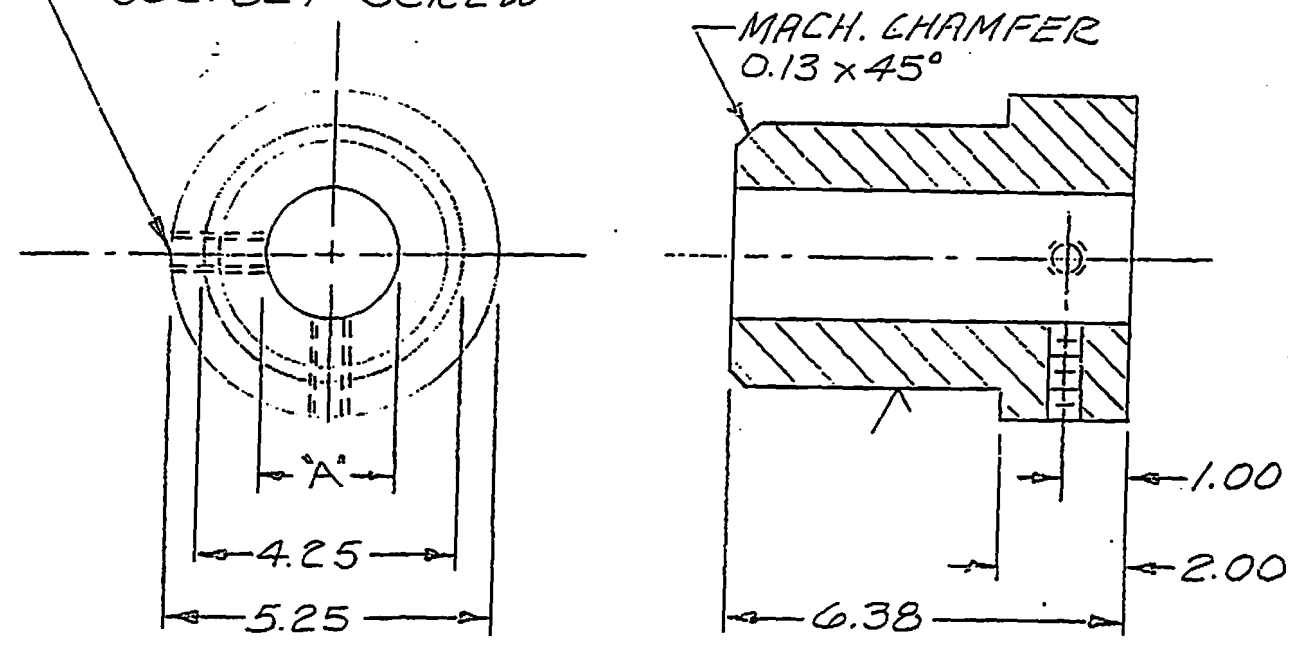
Printed in U.S.A.

0432q/19

NOTES
1. FOR LARGER SIZES SEE F-12744



ITEM	STEM SIZE	"A" DIA. BORE
01	1.50	1.515
02	1.75	1.765
03	2.00	2.015
04	2.25	2.265
05	2.50	2.515
06	2.75	2.765
07	3.00	3.015
08	3.25	3.265
09	3.50	3.515
10	3.75	3.765

ITEM # 010003

CODE "A"
APPROVED AS SUBMITTED

CORPS OF ENGINEERS, U.S. ARMY
SACRAMENTO DISTRICT

Certified for approval by Gene R. Ernst
Date: 08-16-91

PATTERN No. 2-C855-00

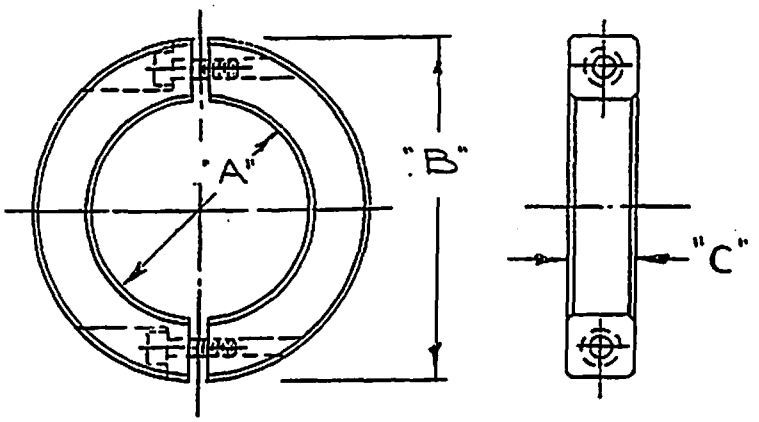
ALT.	CHANGE	BY	CKD	DATE
A	ADDED NOTE 1.	TFB		9-8-89

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

DETAIL: INTERNAL STEM GUIDE FOR MEDIUM & HEAVY MODULAR DISCS

DRAWN YOKAHO	DESIGNED	DATE 9-29-87
CHECKED DRL.	APPROVED	SCALE N.T.S.
INDEX SYMBOL	ORDER NO. 1HM	DWG. NO. F-12412

6458 RUNNING 4



ITEM	+.003" -.000" "A" DIA	"B"	"C"	PART Nº
1	1.00"	2.00"	0.50"	SPL-16 SS
2	1.25"	2.25"	0.50"	SPL-20SS
3	1.50"	2.50"	0.50"	SPL-24 SS
4	1.75"	3.00"	0.62"	SPL-28SS
5	2.00"	3.25"	0.62	SPL-32SS
6	2.25"	3.50"	0.62"	SPL-36 SS
7	2.50"	4.00"	0.75"	SPL-40SS
8	2.75"	4.25"	0.75"	SPL-44SS
9	3.00"	4.50"	0.75"	SPL-48SS
10	3.25"	4.75"	0.75"	SPL-52SS
11	3.50"	5.00"	0.75"	SPL-56SS
12	3.75"	5.75"	1.00"	SPL-60SS
13	4.00"	5.75"	1.00"	SPL-64SS
14	1.37"	2.37"	0.50	SPL-22SS

A

MANUFACTURED BY STAFFORD MFG. CO.

MAT'L. SS 303

ALT.	CHANGE	BY	CKD	DATE
A	ADDED IT. 14	TFB		10-12-87

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

DETAIL: SPLIT CLAMPING COLLAR
FOR USE AS LOWER STOP COLLAR

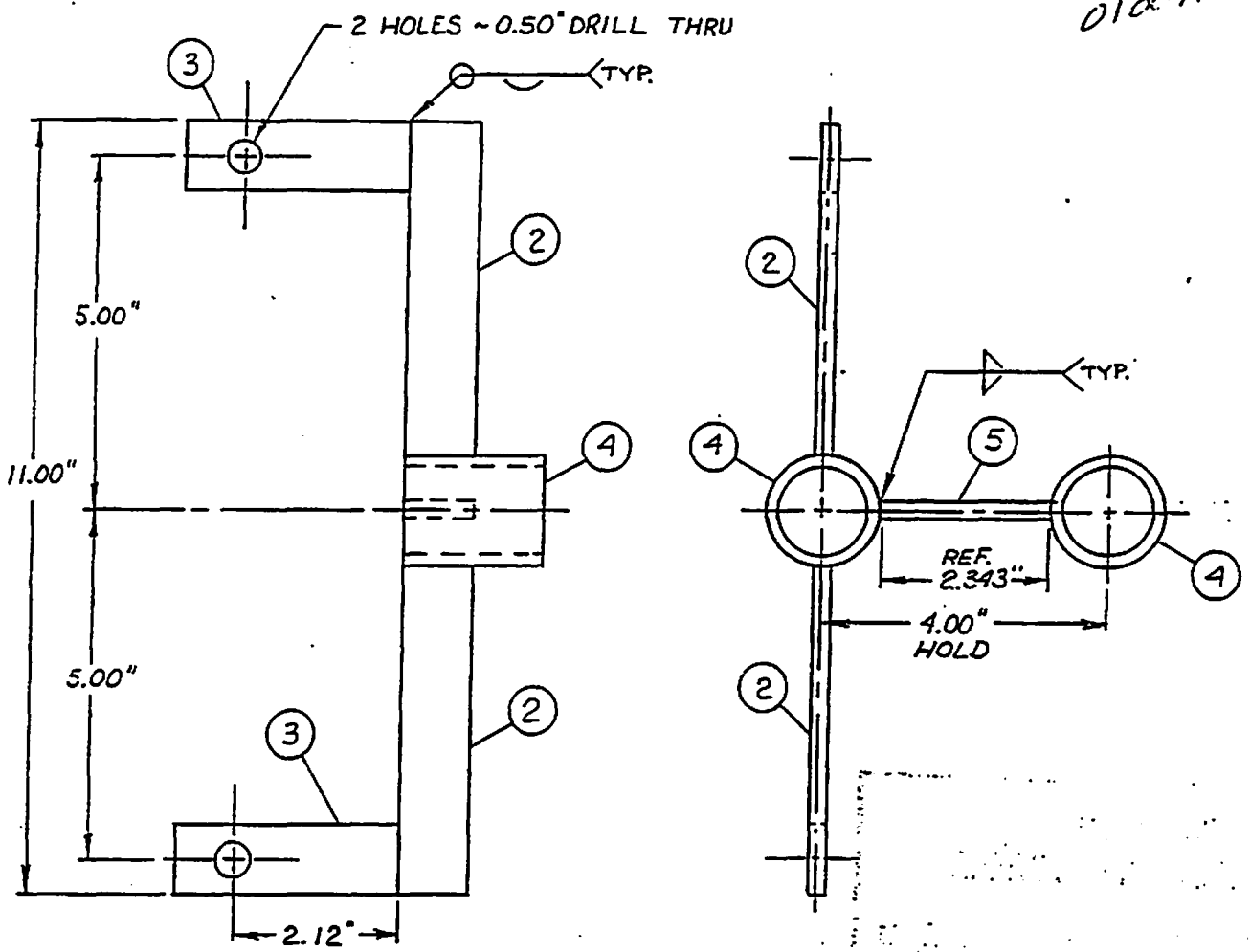
DRAWN WCD	DESIGNED PGV	DATE 2-18-
CHECKED PGV	APPROVED	SCALE N.T.S.
INDEX SYMBOL	ORDER NO.	DWG. NO. F-11050

PAT. PEND.

BRUNING 40-22 46458

NOTES

ITEM II
010-11



(2) PLATE ~0.25" × 1.00" × 4.68" ~ 2 REQ'D. ~A36 ST'L.

(3) PLATE ~ 0.25" × 1.00" × 3.25" ~ 2 REQ'D. ~A36 ST'L.

(4) PIPE ~ 1¼" - SCHEDULE 40 × 2.00" LG. ~ 2 REQ'D ~ A36 ST'L

(5) PLATE ~ 0.25" × 1.00" × 2.37" ~ 1 REQ'D ~ A36 ST'L.

(6) PADLOCK - BRASS PADLOCK ~ McMASTER-CARR - CATALOG NO. 1196A18 ~ 2 REQ'D.

AUG 10 1991

ALT.	CHANGE	BY	CKD	DATE

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

DETAIL: PINION LOCKING DEVICE FOR S-5012 HOIST

DRAWN WEL	DESIGNED WEL	DATE 7-9-81
CHECKED DRL.	APPROVED	SCALE N.T.S.
INDEX SYMBOL	ORDER NO.	DWG. NO. F-10932

DRUMING 40-6458

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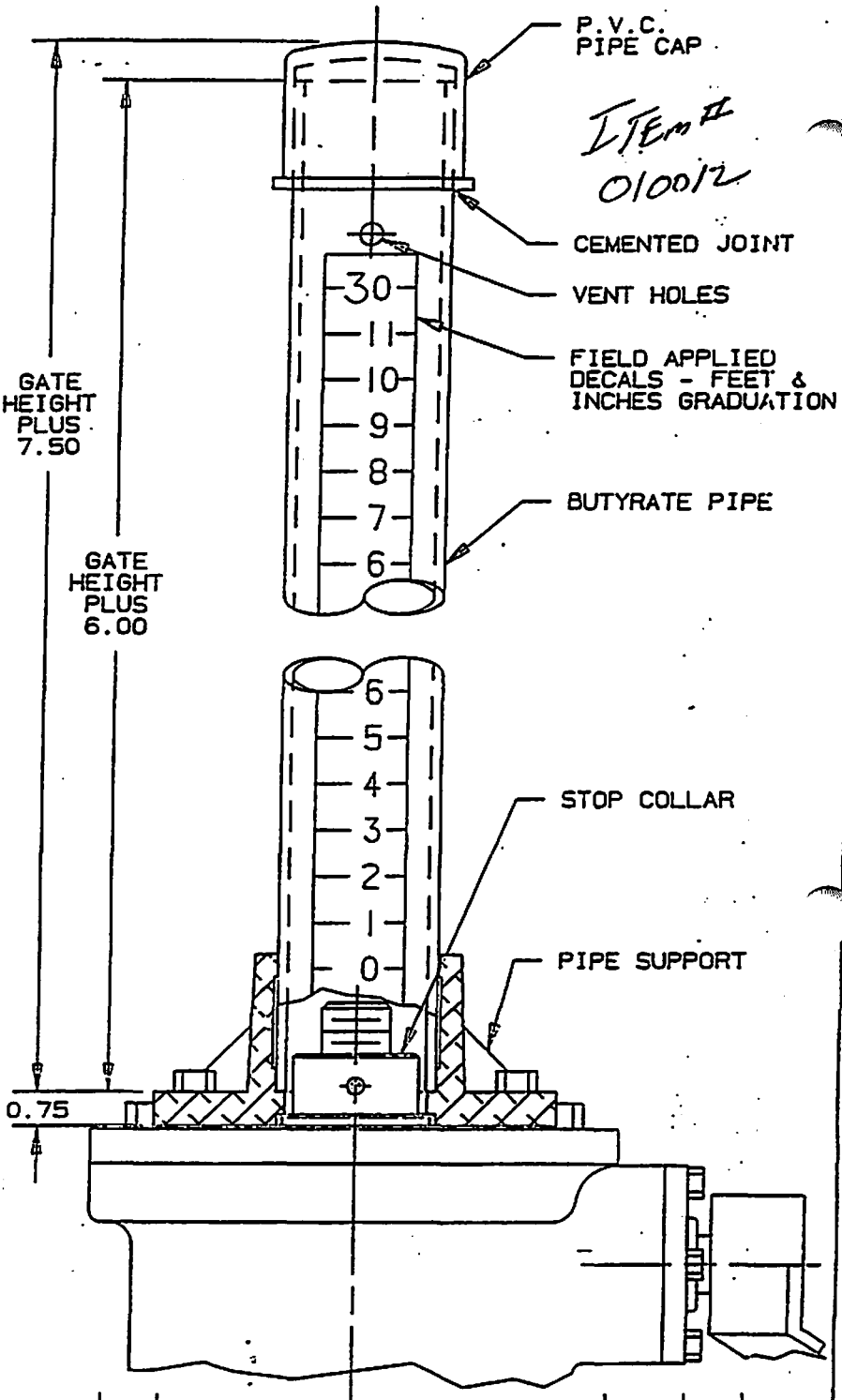
Exhibit H
13 of 26

STEMS UP TO 2.00 DIA.		STEMS 2.25 TO 3.00 DIA.	
3.00 PIPE		4.00 PIPE	
ITEM	GATE HGT.	ITEM	GATE HGT.
01	18.00	26	18.00
02	20.00	27	20.00
03	21.00	28	21.00
04	24.00	29	24.00
05	30.00	30	30.00
06	36.00	31	36.00
07	42.00	32	42.00
08	48.00	33	48.00
09	54.00	34	54.00
10	60.00	35	60.00
11	66.00	36	66.00
12	72.00	37	72.00
13	78.00	38	78.00
14	84.00	39	84.00
15	90.00	40	90.00
16	96.00	41	96.00
17	102.00	42	102.00
18	108.00	43	108.00
19	114.00	44	114.00
20	120.00	45	120.00
21	126.00	46	126.00
22	132.00	47	132.00
23	138.00	48	138.00
24	144.00	49	144.00



ALT.	CHANGE	BY	CKD	DATE
G	REDRAWN - NO CHANGE	TFB		1-88

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

ASSEMBLY : CLEAR STEM COVER FOR S-5004, S-5012, S-5020, S-5036 & S-5054 CRANK OPERATED HOISTS

RE-DRAWN	TFB	DESIGNED	DATE 1-19-88
CHECKED		APPROVED	SCALE N.T.S.
ORD. NO.			DWG. NO. F-9323

INDEX SYMBOL IBM V

Amerlock® 400
High-solids epoxy coating

ITEM # 01 0013

Product Data

- VOC-compliant
- High-performance general maintenance coating for new or old steel
- Cures through wide temperature range
- Self-priming topcoat over most existing coatings
- Can be overcoated with wide range of topcoats
- Compatible with prepared damp surfaces
- Compatible with adherent rust remaining on prepared surfaces
- 5 mils or more in a single coat
- Resists high humidity and moisture

Typical Uses

Amerlock 400 is used in those areas where blasting is impractical or impossible. As a maintenance coating, Amerlock 400 protects steel structures in industrial facilities, bridges, tank exteriors, marine weathering, offshore, oil tanks, piping, roofs, water towers and other exposures. Amerlock 400 has good chemical resistance to splash/spillage, fumes and immersion in neutral, fresh and salt water (see resistance table). Contact your Ameron representative for specific information.

Outstanding Characteristics

Amerlock's low solvent level meets VOC requirements, reduces the chances for film pinholing and solvent entrapment at the substrate-coating interface, often a major cause of coating failure with conventional epoxies and lower solids systems.

Amerlock 400 is available in a variety of colors, including aluminum, and therefore does not require a topcoat. For extended weatherability or special uses, a topcoat may be desired.

Application Data Summary

See application instructions for complete information on surface preparation, environmental conditions, application and safety precautions. To obtain maximum performance, apply as recommended. Adhere to all safety precautions during storage, handling, application and drying periods.

Physical Data[a]

Finish	Semigloss	
Color	Standard, Rapid Response, custom colors[b] and aluminum[c]	
Components	2	
Curing mechanism	Solvent release and chemical reaction between components	
Volume solids (ASTM D2697 modified)		
400	83% ± 3%	
400AL	88% ± 3%	
Dry film thickness (per coat)	5 to 8 mils (125 to 200 microns)	
Coats	1 or 2	
Theoretical coverage[d]		
1 mil (25 microns)	ft²/gal	m²/L
400	1331	32
400AL	1411	34.6
5 mils (125 microns)		
400	266	6.5
400AL	282	6.9
VOC	lb/gal	g/L
400 mixed	1.4	163
mixed/thinned (½ pt)	1.7	204
400AL mixed	1.0	120
mixed/thinned (1½ pt)	2.0	239
400FD mixed	1.2	146
mixed/thinned (½ pt)	1.6	189
Temperature resistance	Dry	
Temperature	°F	°C
continuous	200	93
intermittent	350	177
Flash point (SETA)	°F	°C
400 resin	131	55
cure	85	29
400FD cure	87	30
400AL resin	110	43
cure	116	47
Amercoat® 8	67	19
Amercoat 65	78	25
Amercoat 12	0	-18

alifications

CORPS OF ENGINEERS COMMENT(S):

1. Apply coating per manufacturers instructions.
2. Observe safety precautions as per manufacturers instructions.
3. Only qualified personnel will be allowed to handle or apply this material.
4. The Contractor shall consult EM 385-1-1 Section 12.E for ventilation and Section 07.B for respitaory requirements.

CODE "B"
APPROVED, SUBJECT TO NOTATIONS

CORPS OF ENGINEERS, U.S. ARMY
SACRAMENTO DISTRICT

Certified for approval by Ron Goldsberry
Date: 08-16-91

133

Amerlock 400 Resistance Table

Environment	Immersion		Splash and Spillage		Fumes and Weathering	
	400	400AL	400	400AL	400	400AL
Acidic	*	*	F	F	G	G
Alkaline	*	*	E	G	E	E
Solvents	*	*	G	G	E	E
Salt water	E	E	E	E	E	E
Water	E	E	E	E	E	E

F - Fair G - Good E - Excellent

** Contact your Ameron representative.*

This table is only a guide to show typical resistances of Amerlock 400 and 400AL. Check with your Ameron representative for specific requirements and corrosion protection needs.

Systems using Amerlock 400 or 400AL

1st Coat	2nd Coat**	3rd Coat**
400	None	None
400	450HS	None
	Amershield™	None
	234	None
* 400	400	None
Dimetcote® EZ-II, 9, 9FT or 12	400	None
Dimetcote EZ-II, 9, 9FT or 12	400	450HS

** Water immersion.*
*** For color contrast when 2 coats of 400AL are used, 400AL red can be used as first coat.*

Recoat/topcoat time @ 70°F (21°C)

System	Maximum time
400/400	3 months
400 with 861/400	1 month
400FD/400FD	2 weeks
400/450HS	7 days
400FD/450HS	4 days
400 or 400FD/234	1 day
400 with 861/234	1 day
400/Amershield	1 month
400FD/Amershield	7 days
400 with 861/Amershield	2 weeks

Note: For topcoats (finish coats) not listed, see product data sheet for specific topcoat time limitations.

Application Data[1]

Applied over	Steel, concrete, aluminum, galvanizing
Surface preparation	Abrasive or water blast, mechanical cleaning
Method	Airless or conventional spray. Brush or roller may require additional coats.
Mixing ratio (by volume)	1 part resin to 1 part cure

Pot life (hours) °F/°C	90/32	70/21	50/10	32/0
w/o accelerator 400	1.5	2.5	4	7
400FD cure	1	1.5	2.5	4
400AL	3.5	5.5	10	15
with accelerator 400, 400AL 861 @ 1 pt/5-gal maximum	0.5	1	1.5	2

Pot life is period of time after mixing that a five-gallon unit is sprayable when thinned as recommended. It is possible that mixture will appear fluid beyond this time period, but spraying and film build characteristics may be impaired.

Environmental Conditions
(During application, drying and curing)

Temperature	Air and Surface
Amerlock 400 or 400AL	40° to 122°F (4° to 50°C)
Amerlock with 861	20° to 122°F (-6° to 50°C)
Amerlock 400FD cure	20° to 122°F (-6° to 50°C)

At freezing temperatures, surface must be free of ice.

Thinner	Amercoat 8 or 65
Cleaner	Amercoat 12

Physical Properties[a] – Typical

Abrasion resistance (ASTM D4060)	
1 kg load/1000 cycles	weight loss
CS-17 wheel	102 mg
Impact resistance (ASTM D2794)	
Direct	24 in-lb
Reverse	6 in-lb
Moisture vapor transmission (ASTM D1653)	17.1 g/m²
Adhesion (ASTM D4541)	900 psi

Performance Properties[a] – Typical

Salt spray (ASTM B117) 3000 hours	
Face blistering	None
Humidity (ASTM D2247) 750 hrs	
Face corrosion, blistering	None
QUV weathering (Accelerated ultraviolet cyclic)	
1000 hours	
blistering	None
gloss retention	56%
Immersion (NACE TM-01-69) fresh water 1 year	
blistering	None

Shipping Data

Packaging	2- and 5-gal units
2-gal unit	1-gal resin in 1-gal can 1-gal cure in 1-gal can
5-gal unit	2.5-gal resin in 5-gal can 2.5-gal cure in 2.5-gal can

Shipping weight (approximate)

	lbs	kg
2-gal unit		
400 cure	12.5	5.7
400FD cure	12.2	5.5
400 resin	13.7	6.2
400AL cure	12.1	5.5
400AL resin	11.0	5.0
5-gal unit		
400 cure	31.5	14.4
400FD cure	31.2	14.2
400 resin	35.0	15.9
400AL cure	30.9	14.0
400AL resin	28.3	12.8

Shelf life when stored indoors at 40° to 100°F (4° to 38°C) is 1 year from shipment date.

Improper use and handling of this product can be hazardous to health and cause fire or explosion. Safety precautions included with the application instructions should be strictly followed during all storage, handling, use and drying periods.

a Numerical values are subject to normal manufacturing tolerances, color and testing variances.

b White and light colors may show yellowing on aging. Do not use Amercoat 861 with white or light colors or with 400FD cure. With white and light colors, 400FD cure will cause yellowing.

c Do not use Amerlock 400AL on water damp surfaces. Do not use 400FD cure with 400AL resin.

d Allow for application losses and surface irregularities.

e Do not use colors containing lead chromate pigment.

f See application instructions for complete information and safety precautions.

Drying Time (ASTM D1640)

861 Accelerator 1 pt/5 gal (18L)	Product System	Touch 120/49 °F/°C hrs	90/32 hrs	70/21 hrs	50/10 hrs	32/0 hrs	20/-6 hrs
None	400	1.5	4.5	9	28	96	NR*
	400AL	1	4	12	36	96	NR
	400FD cure	0.5	1	2	8	24	48
0.5	400	1.5	3	5	24	72	120
	400AL	1	1.5	2.5	5	10	24
1	400	1	2	4	15	48	96
	400AL	1	1.5	2.5	5	10	24

		Through					
None	400	6	12	20	40	140	NR
	400AL	1.5	7.5	24	72	216	NR
	400FD cure	1.5	2.5	4.5	13	38	96
0.5	400	3 -	6	10	30	96	180
	400AL	2	4	9	24	48	120
1	400	2.5	5	9	24	72	160
	400AL	2	4	7	16	36	120

		Cure for Immersion					
		days	days	days	days	days	days
None	400 and 400AL	2	4	7	21	NR	NR
	400FD cure	1	2	3	7	21	NR
0.5 or 1	400 and 400AL	1	2	3	7	21	NR

**Not recommended*

Warranty

Ameron warrants its products to be free from defects in material and workmanship. Ameron's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Ameron's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the nonconforming products. Any claim under this Warranty must be made by Buyer to Ameron in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the delivery date, whichever is earlier. Buyer's failure to notify Ameron of such nonconformance as required herein shall bar Buyer from recovery under this Warranty.

Ameron makes no other warranties concerning the product. No other warranties, whether expressed, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Ameron be liable for consequential or incidental damages.

Any recommendation or suggestion relating to use of the products made by Ameron, whether in its technical literature, or in response to specific inquiry or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

Limitation of Liability

Ameron's liability on any claim of any kind, including claims based upon Ameron's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or part thereof which give rise to the claim. In no event shall Ameron be liable for consequential or incidental damages.

Amercoat
Protective Coatings Division

Product Data/ Application Instructions

Amercoat® 450HS
Aliphatic polyurethane

Glossy topcoat

Outstanding weather resistance with excellent color and gloss retention

Resistant to broad range of corrosive atmospheres

Resists soil pickup - cleans easily

Cures through wide temperature range

Hard, flexible, and abrasion resistant

Typical Uses

As a finish coat where attractive appearance and a wide range of corrosive resistance is required - chemical plants, pulp and paper mills, off shore platforms, petroleum refineries, containers.

Surface Preparation

Coating performance, in general, is proportional to the degree of surface preparation. Refer to application instructions for specific primers and intermediate coats being used for application and curing procedures. All previous coats must be clean and dry. Aged epoxy coatings may require special treatment.

Application Equipment

The following is a guide; suitable equipment from other manufacturers may be used. Changes in pressure and tip size may be needed for proper spray characteristics.

Airless spray - Standard equipment such as Graco, DeVilbiss, Binks, Speeflo, or others having a 28:1 or higher pump ratio and a fluid tip with 0.013 to 0.017-inch (0.33 to 0.43 mm) orifice.

Conventional spray - Industrial equipment such as DeVilbiss MBC or Binks BBR spray gun. Separate air and fluid pressure regulators, mechanical pot agitator and a moisture and oil trap in main air supply line are recommended.

Application Procedure

Amercoat 450HS is packaged in two components in the proper proportions which must be mixed together before use:

1. Flush equipment with Amercoat 12 before use.

Finish	Gloss
Color	See color card*
Components	2
Curing mechanism	Solvent release and chemical reaction between components

Volume solids (ASTM D2697 modified)	
450HS	66% ± 3%
Clear coat	52% ± 3%
Dry film thickness per coat	2 mils (50 microns)

Theoretical coverage[b] (light colors)	ft^2/gal 450HS	ft^2/gal Clear	m^2/L 450HS	m^2/L Clear
1 mil (25 microns)	1058	834	25.9	20.4
2 mils (50 microns)	529	417	12.9	10.2

VOC	lb/gal	g/L
Mixed	2.8	336
Mixed/thinned	3.3	395

Temperature resistance (Dry)	°F	°C
continuous	200	93
intermittent	250	121

Flash point (SETA)	°F	°C
cure	96	35
resin	100	38
mixed	98	37
Amercoat 920	134	57
Amercoat 12	0	-18

Application Data	
Applied over	Concrete or primed steel
Surface preparation	As per specific primer or intermediate
Method	Airless or conventional spray
Coats*	1-2

* Uniform appearance may require two coats on tanks and other large structures previously coated with contrasting primer or intermediate coat.

Topcoat Color	Substrate Color		
No. of Coats	White	Light	Dark Contrast
450HS white	1	2	2
450HS-HH white	1	1	2
450HS pastels	1	1	2
450HS-LT** yellow, red, orange	2	2	2

** LT colors do not contain lead chromate pigments.

Amercoat 450HS resin - Flammable. Warning! Contains acrylic copolymer resin, butyl acetate, ketone and aromatic hydrocarbons. Lead chromate in some colors. Vapor and spray mist can be harmful. Irritating to eyes, skin, mucous membranes, and respiratory system; can cause headache, nausea, dizziness or asphyxiation. Can be harmful if inhaled, swallowed or absorbed through the skin. Kidney and liver damage can occur. Possible skin sensitization. Excessive, long-term exposure to lead-containing colors can cause lead poisoning. Lead chromate is a cancer-suspect agent.

First aid - Overexposure to vapor or spray mist, provide fresh air. Give artificial respiration or oxygen if breathing is labored. For skin contact, wash thoroughly with soap and water. For eyes, flushed immediately with plenty of water for at least 15 minutes and get medical attention. If swallowed, do not induce vomiting, call physician. If breathing difficulty persists or occurs later consult a physician and have label information available.

Hygienic practices - Wash thoroughly before eating, smoking or using washroom. Launder contaminated clothing before reuse. Destroy contaminated shoes or leather material.

Hazards - Keep away from heat, sparks, arc and open flame; avoid breathing vapor, dust, spray mist or contact with eyes and skin. Use adequate ventilation during mixing, application and drying to prevent concentration of solvent vapors and other hazardous fumes. Reports associate repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Wear protective equipment such as goggles, face protection, gloves, full protective clothing and properly fitted, NIOSH certified respirator during mixing, spraying and until all vapors and mists are gone. In confined, poorly-ventilated areas, use airline, hood-type respirator and explosion- and spark-proof equipment. Welding and cutting can produce hazardous fumes and gases; follow the American National Standard Z49.1 - 1983, "Safety in Welding and Cutting." For polyurethanes or isocyanates a properly fitted, positive-pressure, air-supplied respirator similar to TC19C NIOSH/MSHA is suggested. Dried film of lead-containing colors can be harmful if chewed or eaten. Do not apply on toys, furniture, or any interior or exterior surfaces to which children may be commonly exposed.

Chemical Resistance Guide (When applied over suitable primer or intermediate coat):

Environment	Splash & Spillage	Fumes & Weathering
Acidic	Very Good	Excellent
Alkaline	Very Good	Excellent
Solvents	Good	Excellent
Salt solutions		
Acidic	Excellent	Excellent
Neutral	Excellent	Excellent
Alkaline	Excellent	Excellent
Water	Excellent	Excellent

This table is only a guide. For specific recommendations, contact your Ameron representative for your particular corrosion protection needs. Amercoat 450HS is not presently recommended for immersion service.

Systems Using Amercoat 450HS

The following are typical systems including Amercoat 450HS, although its use is not necessarily restricted to these combinations.

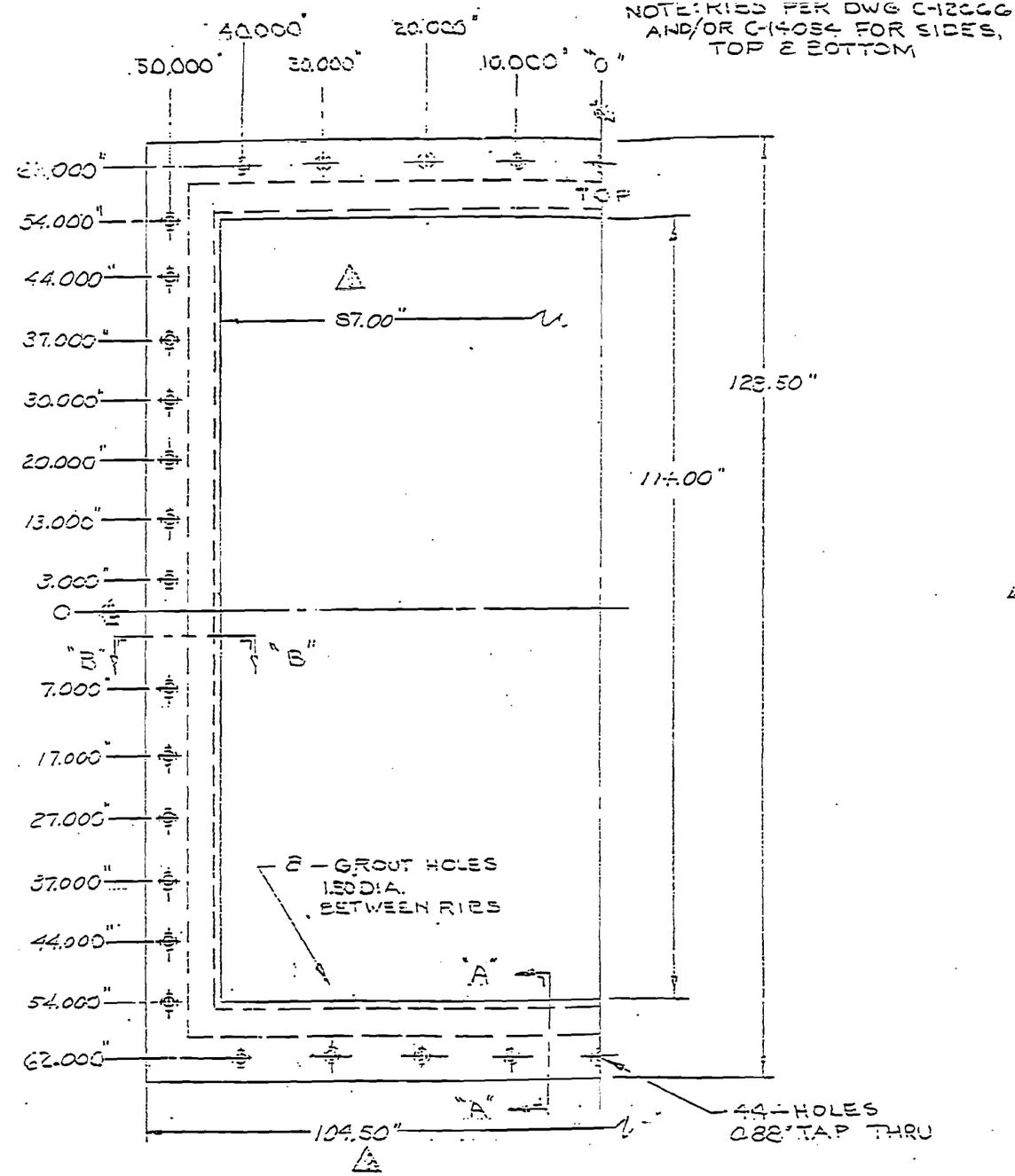
First* Coat	Intermediate Coat	Finish Coat
Dimetcote® 6, 9 or DEZ-11	385 or 383HS	450HS
Amercoat 71, 83HS, 182, 185, or 385		450HS
Amerlock® 400	—	450HS

*Maximum curing time at 70°F (21°C) for epoxy coatings varies when overcoating with Amercoat 450HS: 383HS - 8 weeks; 400, 182, 83HS, 71 - 2 weeks; 400 plus 861 - 1 week; 385 - 4 weeks; 385 plus 861 - 1 week.

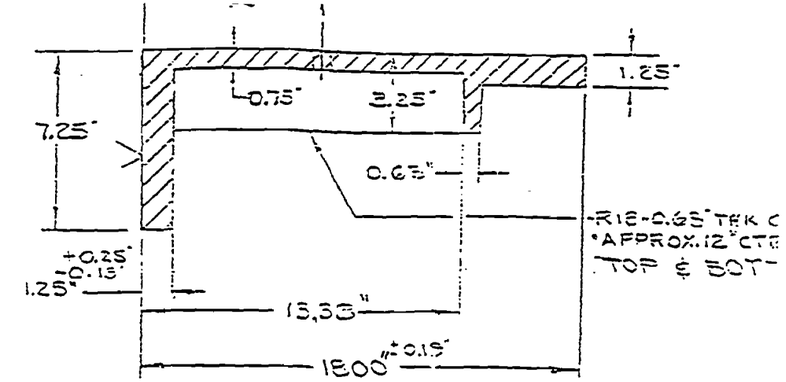
Curing time - Rate of curing is dependent on temperature. At 65 to 75°F (18 to 24°C) a full cure requires seven days. For many types of service, coating may be used before final cure is attained. See application instructions.

Fire - Blanket flames with dry chemical, carbon dioxide or foam. Wear self-contained breathing apparatus.

NOTE: RIBS PER DWG C-12666 AND/OR C-14054 FOR SIDES, TOP & BOTTOM

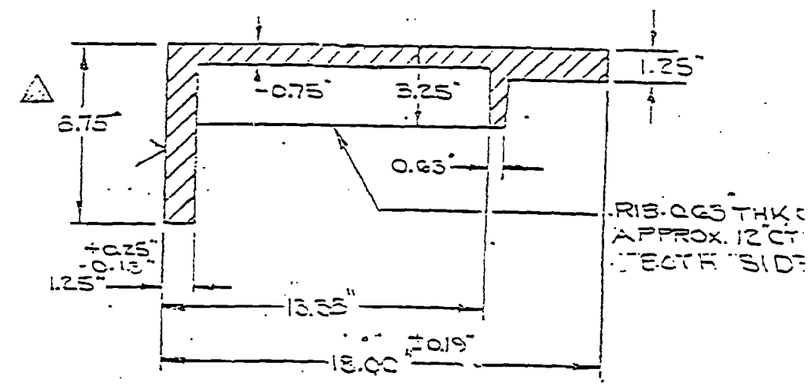


TEMPLATE NO. B-090035



SECTION A-A

ITEM # 01000



SECTION B-B

△ SPECIAL

PATTERN NO. 2-E132-00

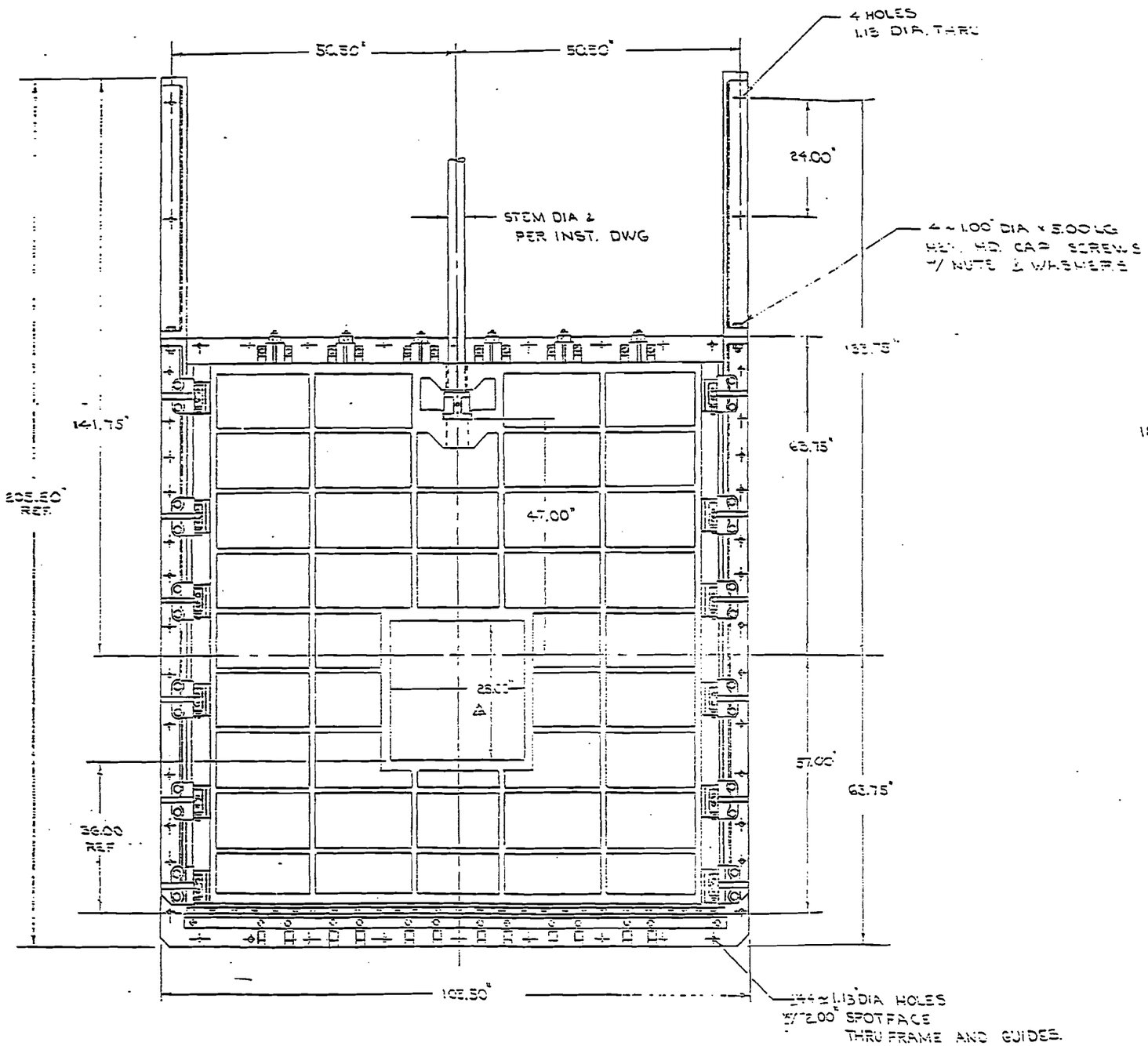
RODNEY HUNT COMPANY, ORANGE, MASS., 01364	18,500
	DETAIL: 87" x 114" WALL
	THIMBLE ~ F-SECTION
	18". DEEP
	F. WEST / FWW / 4-15-
	DRL. / / NT
PL / EM	E-415

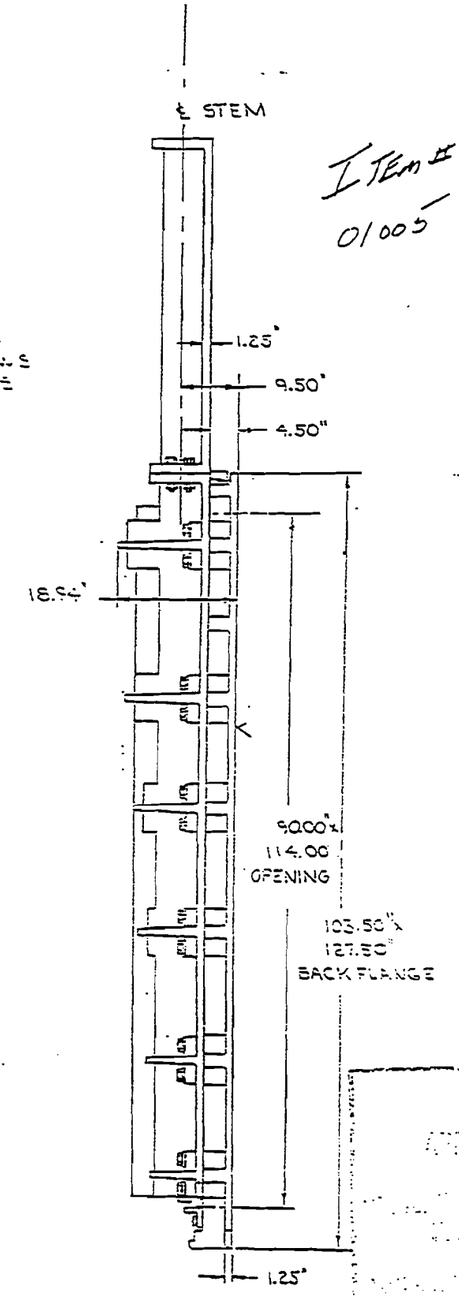
REF: D-28048

Ed. Cut

AUG 7

138





Item # 01005

DISC	E-21333-C1
FRAME	D-33331-C1
GUIDE	D-33362-C1
GUIDE ELT	E-20120-C1
TOP WEDGE	E-15195
SIDE WEDGE	E-33513 A
STOP BAR	E-23235
RET. PLATE	F-9970
SEAL	F-11286
THRUST NUT	E-16021

CONFORMED
APPROVED FOR LIMITED
CONSTRUCTION PRIOR TO
FINAL APPROVAL
AUG 16 19

SPECIAL

TEMPLATE NO. TB-09.0036

CHANGE	BY	CKD	DATE	ALT.	CHANGE	BY	CKD	DATE	ALT.	CHANGE	BY	CKD	DATE	ALT.	CHANGE	BY	CKD	DATE	ALT.	CHANGE	BY	CKD	DATE

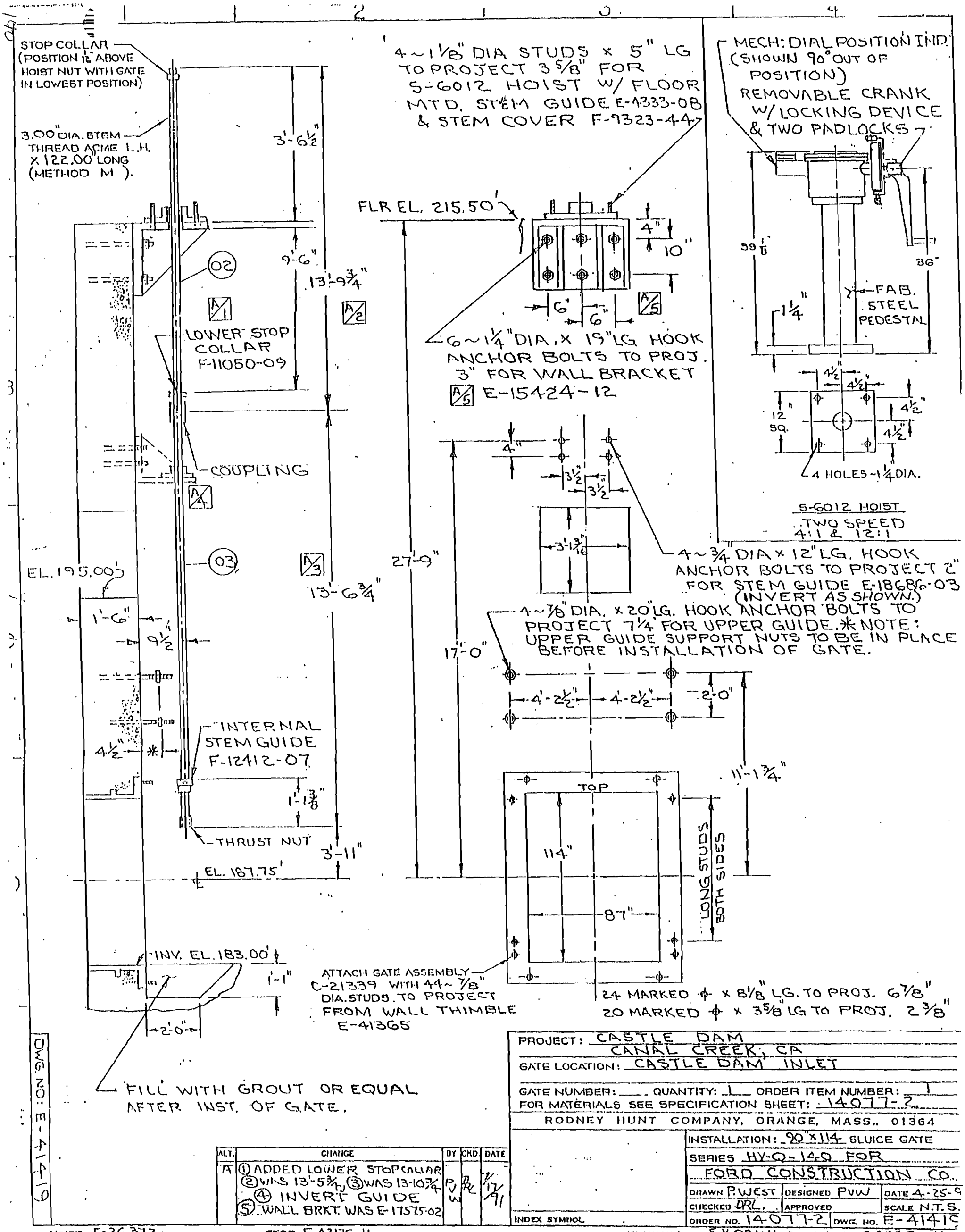
139

RODNEY HUNT COMPANY, ORANGE, MASS. 01364

ASSEMBLY: 90" x 114" SLUICE GATE ~ SERIES HY-Q-120

DRAWN P. WEST | DESIGNED | DATE 4-24
CHECKED | APPROVED | SCALE N.T.
ORDER NO. | DWG. NO. C-21339
INDEX SYMBOL

Exhibit ~~Sheet~~ 21 of 26



DWG. NO: E-41419

ALT.	CHANGE	BY	CKD.	DATE
A	① ADDED LOWER STOP COLLAR ② WAS 13'-5¾" ③ WAS 13-10¾" ④ INVERT GUIDE ⑤ WALL BRKT. WAS E-17575-02	PJW	DRL	7/17/91

PROJECT: CASTLE DAM CANAL CREEK, CA

GATE LOCATION: CASTLE DAM INLET

GATE NUMBER: ____ QUANTITY: 1 ORDER ITEM NUMBER: 1

FOR MATERIALS SEE SPECIFICATION SHEET: 14077-2

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

INSTALLATION: 90"x114 SLUICE GATE

SERIES HV-Q-140 FOR FORD CONSTRUCTION CO.

DRAWN P. WEST | DESIGNED PVW | DATE 4-25-9

CHECKED DRL | APPROVED | SCALE N.T.S.

INDEX SYMBOL | ORDER NO. 14077-2 | DWG. NO. E-41419

HOIST: E-26372 W/CRANK E-20187

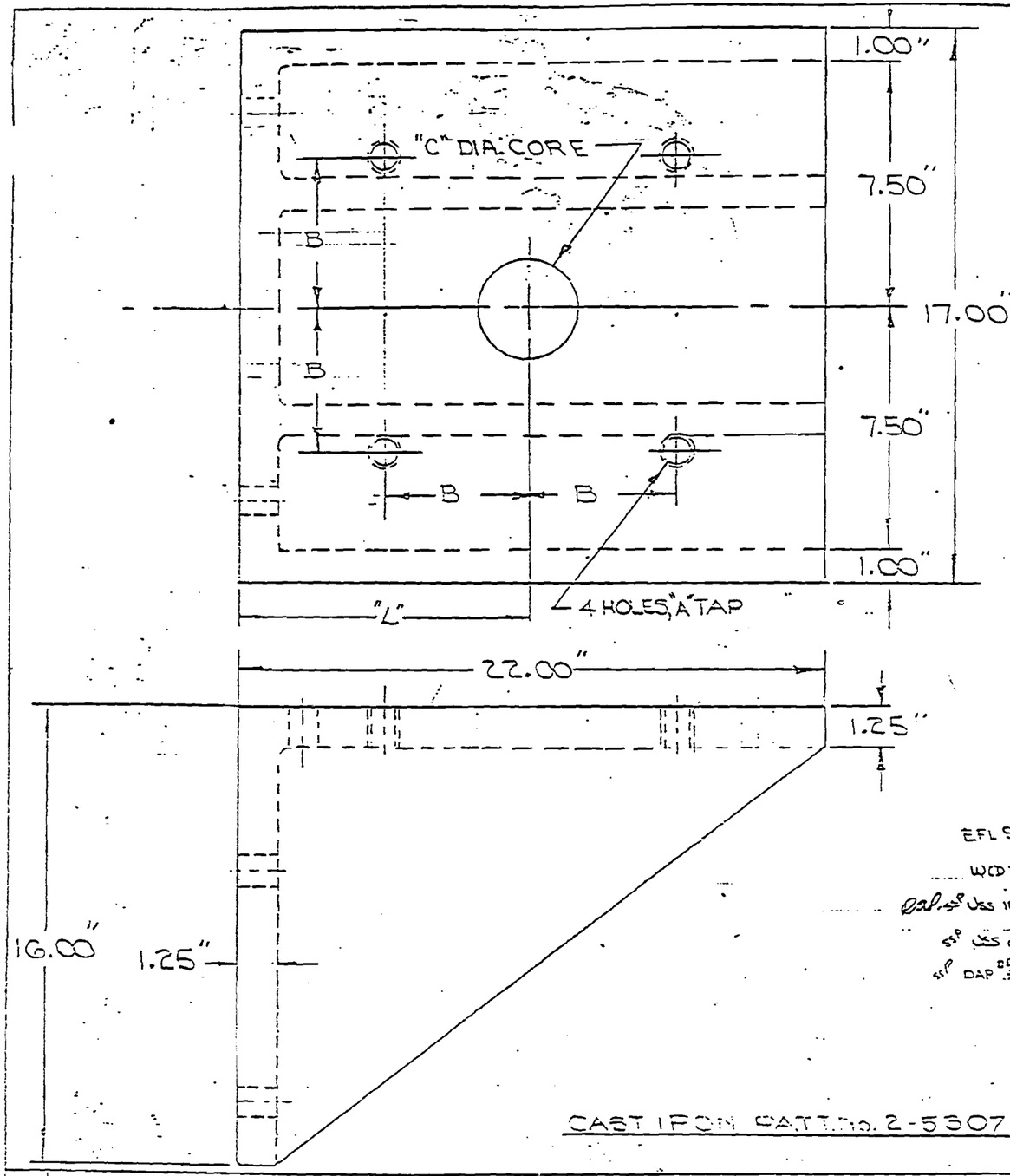
STOP COLLAR: F-4217C-11

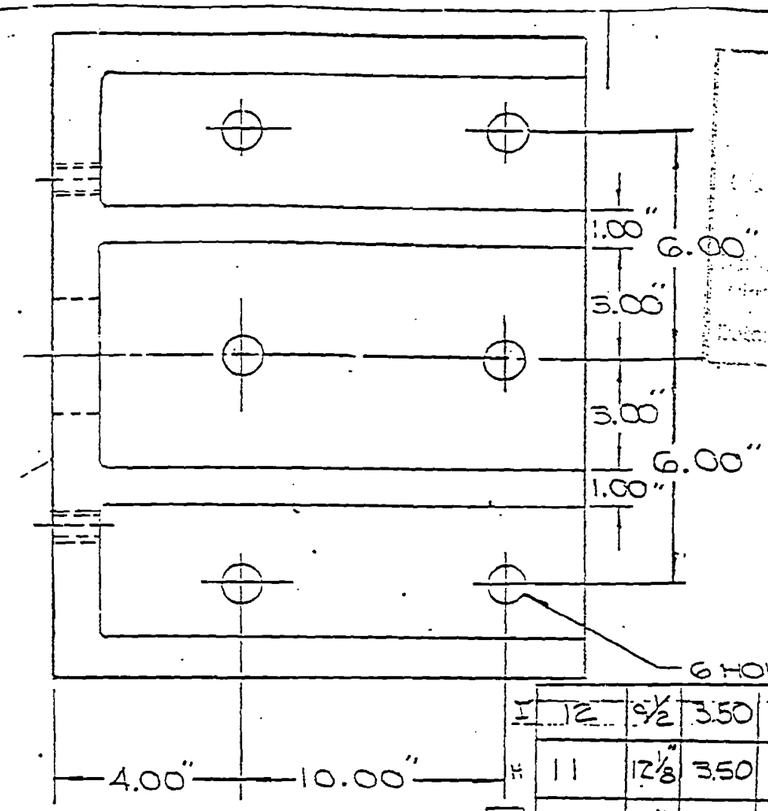
THRUST NUT: E-16021-11 ATTACH PER: E-16026-11

COUPLING: E-6565-11 ATTACH PER: E-6560-11

AUG 16

Item H
010002





NOTES

CODE "A"
APPROVED SUBMITTED
AUG 16 1991
ITEM E
010007

	17	11.12	4.00	1.00	4.50	
	16	14.12	4.00	1.12	4.50	
	15	13.62	3.50	1.00	4.50	
	14	15.62	3.50	1.00	4.50	
	13	13.12	3.50	1.12	4.50	
	ITEM	L	C	A	B	

EFL 9-1-82
WCD 2-8-82
10-14-80
8-26-80
DAP

	ITEM	"L"	"C"	"A"	"B"
I	12	9 1/2	3.50	1.12	4.50
H	11	12 1/8	3.50	1.12	4.50
G	10	14"	3.50"	1.12"	4.50
F	9	11 1/2"	3.50"	1.12"	4.50
E	8	9 1/2	3.50"	1.25"	7.00"
D	7	13	3.50	1.12"	4.50"
C	6	11 5/16	3.00"	1.12"	4.50"
C	5	10"	3.00"	1.00"	4.50"
B	4	8 3/4	3.00	1.12"	4.50"
A	3	10"	3.00"	1.12"	4.50
	2	9"	3.00	1.12"	4.50"
	1	8 9/16	3.50	1.12"	4.50"

PATT. RE-INSTATED 3-18-74 CAP SSP

CAST IRON PATT. No. 2-5307-04

RODNEY HUNT MACHINE CO., ORANGE, MASS., U. S. A.

HOIST BRACKET

S-5004 THRU S-5020

LONG ℄ TO BACK

DRAWN P. WEST	DESIGNED	DATE 7-2-74	
CHECKED	APPROVED	SCALE	
INDEX SYMBOL IBM-PE-V	ORDER NO.	DWG. NO. E-15424	

ALT.	CHANGE	BY	CKD.	DATE	ALT.	CHANGE	BY	CKD.	DATE
A	ADDED ITEM # 3	XL		10-20-75	E.	ADDED ITEM NO. 8	DRL		11-1-76
B	ADDED # 4	PG	SSP	10/23/75	F.	ADDED IT # 9	MR	SSP	12-6-76
C	ADDED # 5 & # 6	PW		10/24/75	G.	ADDED IT. # 10	JR		1-25-77
D.	ADDED # 7	PW		6/16/76	H	ADDED ITEM # 11	RA		11/8/78
					I	ADDED ITEM # 12	PW		2/2/79

FOUNDRY ISSUED

E-5775

K-E © BRANCHE 1951 E. L. M. INC.

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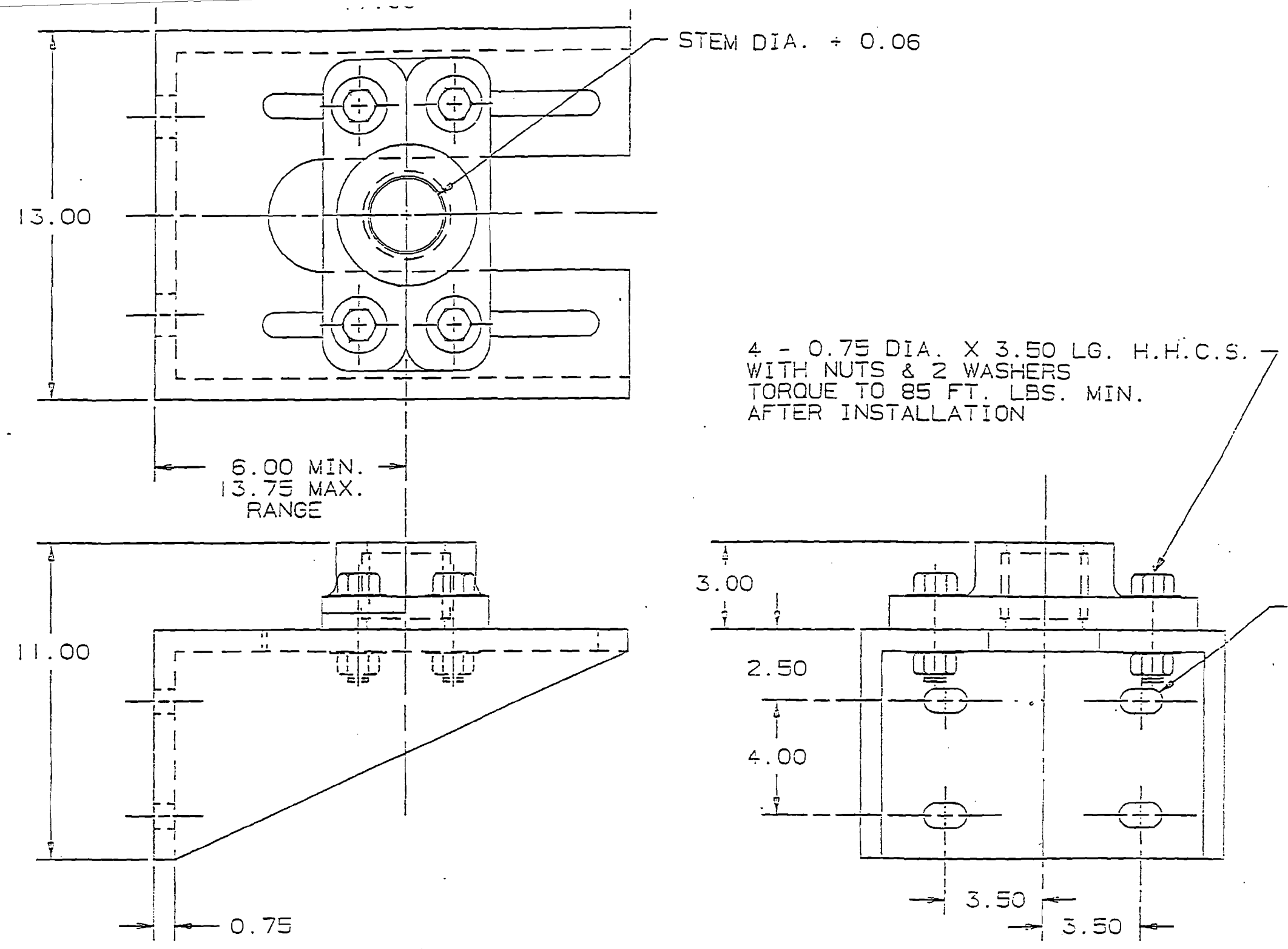


ITEM	STEM
01	2.50
02	2.75
03	3.00

AUG 16 1991

Item # 010006

ALT.	CHANGE	BY	CKD	DATE	ALT.	CHANGE	BY	CKD	DATE

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

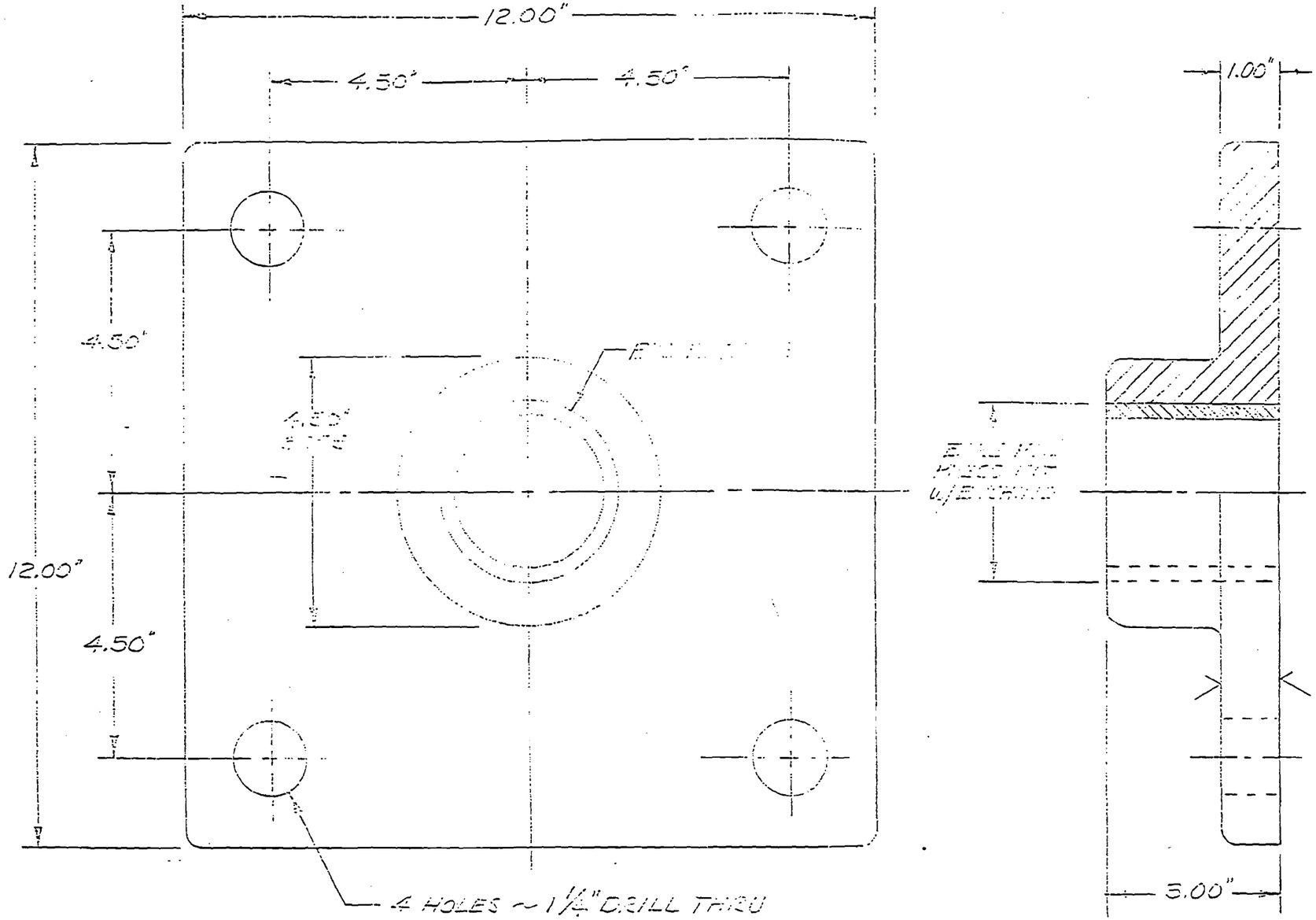
ASSEMBLY : SPLIT 4-BOLT STEM GUIDE

BRZ. BUSHED RANGE 6.00 TO 13.75

RE-DRAWN TFB	DESIGNED	DATE 7-8-85	
CHECKED DRL	APPROVED	SCALE N.T.S.	
INDEX SYMBOL IBM V	ORDER NO.	DWG. NO. E-18686	

BRKT. : E-18616-02 GUIDE : D-27548 & D-27549 BUSHING : F-4448

142



NOTES

ITEM	STEM DIA.	BUSHING PART
01	2.75"	10
02	2.50"	09
03	3.50"	13
04	3.25"	12
05	2.25"	08
06	1.37"	04
07	2.0"	07
08	3.00"	11
09	1.75"	06
10	1.50"	05
11	1.25"	03
12	2.50"	SPECIAL
13	1.00"	01

ITEM #
010009

CODE "A"
APPROVED AS SUBMITTED
CHIEF ENGINEER, U.S. ARMY
PATTERN NO. 2-2655-P-03
Approved: [signature]
Date: AUG 16 1991

DRILL JIG No. C-77

ALT.	CHANGE	BY	CKD.	DATE	ALT.	CHANGE	BY	CKD.	DATE
C	RE-DRAWN W/O CHANGE	[illegible]		[illegible]					

RODNEY HUNT COMPANY, ORANGE, MASS., 01364

DETAIL: FLOOR MOUNTED STEM
GUIDE ~ BRONZE BUSHED

RE-DRAWN PAUGHAN	DESIGNED	DATE 6-24-85
CHECKED DRL.	APPROVED	SCALE HALF
INDEX SYMBOL	ORDER NO.	DWG. NO. E-4333

BRUNING 46450-3

GEAR BOX D-21771 STAMP PAT

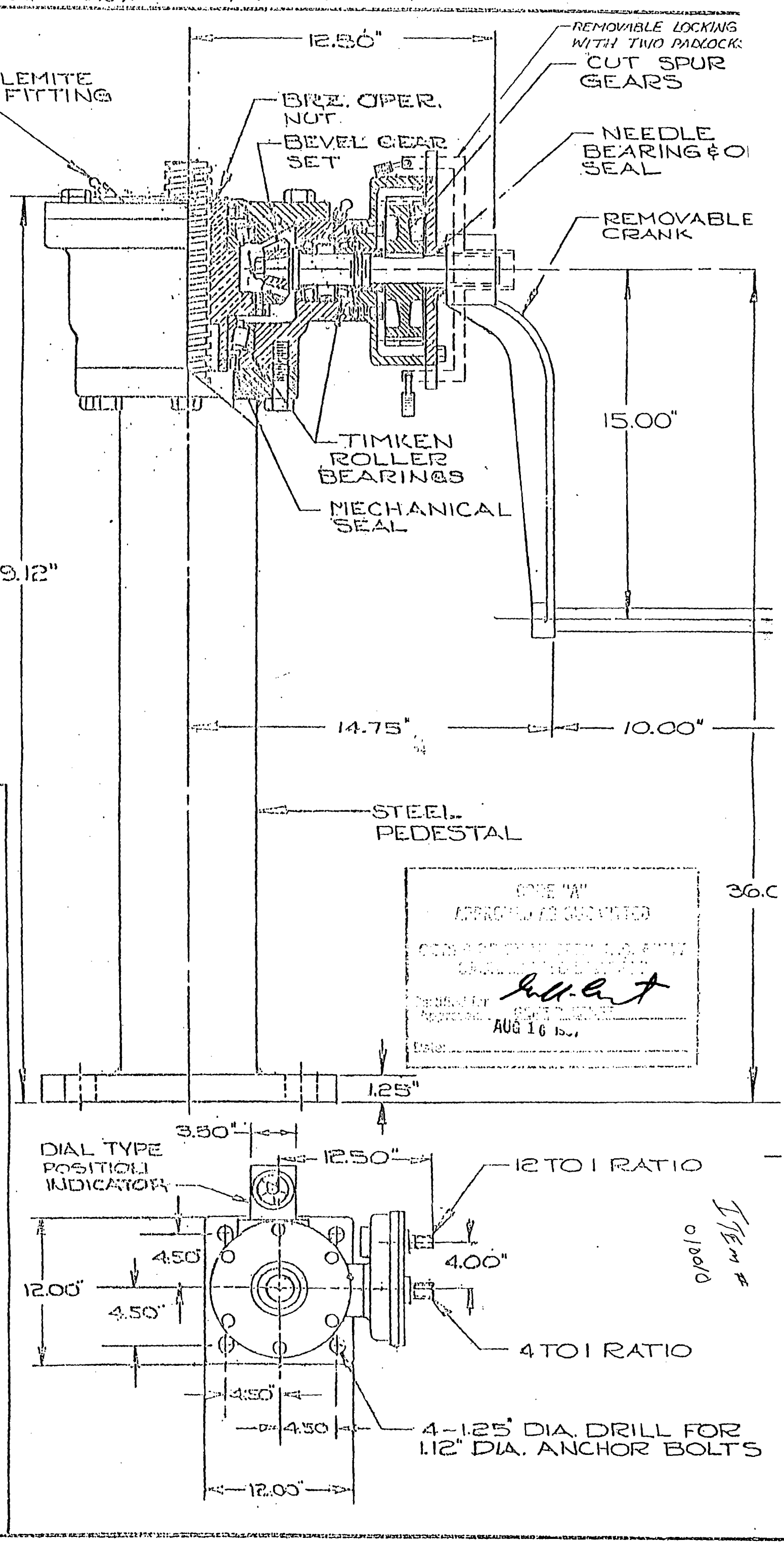


EXHIBIT I
DATA RECORDING TABLE AND BACK-UP DATA

EXHIBIT I

DATA RECORDING TABLE AND BACK-UP DATA

Midnight readings for CTLP and CCL as recorded since installation of the Data Recorders at Castle Dam Pool and Canal Creek Stream Gage.

	Castle Dam Pool CTLP			Canal Creek CCL	
Date	Pool Elev (ft)	Gate (ft)	Batt (V)	Stage (ft)	Batt (V)
	Table to be filled with actual data.				

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
29SEP1992	183.11	7.00	2.49
30SEP1992	183.11	7.00	2.49
01OCT1992	183.11	7.00	2.49
02OCT1992	183.11	7.00	2.49
03OCT1992	183.10	7.00	2.49
04OCT1992	183.10	7.00	2.49
05OCT1992	183.10	7.00	2.49
06OCT1992	183.10	7.00	2.49
07OCT1992	183.10	7.00	2.49
08OCT1992	183.09	7.00	2.21
09OCT1992	183.09	7.00	2.16
10OCT1992	183.09	7.00	2.10
11OCT1992	183.09	7.00	2.06
12OCT1992	183.09	7.00	2.28
13OCT1992	183.09	7.00	2.39
14OCT1992	183.24	7.00	2.46
15OCT1992	183.11	7.00	2.45
16OCT1992	183.35	7.00	2.45
17OCT1992	183.28	7.00	2.51
18OCT1992	183.14	7.00	2.45
19OCT1992	183.11	7.00	2.42
20OCT1992	183.11	7.00	2.42
21OCT1992	183.33	7.00	2.48
22OCT1992	183.29	7.00	2.51
23OCT1992	183.27	7.00	2.55
24OCT1992	183.26	7.00	2.49
25OCT1992	183.16	7.00	2.45
26OCT1992	183.11	7.00	2.40
27OCT1992	183.11	7.00	2.43
28OCT1992	183.10	7.00	2.40
29OCT1992	183.11	7.00	2.43
30OCT1992	183.32	7.00	2.49
31OCT1992	183.29	7.00	2.49
01NOV1992	183.27	7.00	2.48
02NOV1992	183.28	7.00	2.46
03NOV1992	183.27	7.00	2.45
04NOV1992	183.28	7.00	2.45
05NOV1992	183.27	7.00	2.46
06NOV1992	183.28	7.00	2.45
07NOV1992	183.32	7.00	2.46
08NOV1992	183.33	7.00	2.48
09NOV1992	183.33	7.00	2.49
10NOV1992	183.33	7.00	2.49
11NOV1992	183.33	7.00	2.49
12NOV1992	183.34	7.00	2.49
13NOV1992	183.33	7.00	2.51
14NOV1992	183.33	7.00	2.48
15NOV1992	183.33	7.00	2.48
16NOV1992	183.31	7.00	2.48
17NOV1992	183.31	7.00	2.46
18NOV1992	183.33	7.00	2.49
19NOV1992	183.33	7.00	2.48
20NOV1992	183.33	7.00	2.48
21NOV1992	183.33	7.00	2.48
22NOV1992	183.33	7.00	2.49
23NOV1992	183.34	7.00	2.49
24NOV1992	183.30	7.00	2.51
25NOV1992	183.29	7.00	2.51
26NOV1992	183.23	7.00	2.49
27NOV1992	183.25	7.00	2.48
28NOV1992	183.22	7.00	2.48
29NOV1992	183.19	7.00	2.46
30NOV1992	183.17	7.00	2.48
01DEC1992	183.28	7.00	2.51
02DEC1992	183.27	7.00	2.49
03DEC1992	183.29	7.00	2.49
04DEC1992	183.33	7.00	2.52
05DEC1992	183.32	7.00	2.54
06DEC1992	183.43	7.00	2.57
07DEC1992	183.49	7.00	2.63
08DEC1992	183.55	7.00	2.63
09DEC1992	183.49	7.00	2.61
10DEC1992	183.46	7.00	2.57
11DEC1992	183.57	7.00	2.60
12DEC1992	183.54	7.00	2.58
13DEC1992	183.53	7.00	2.57
14DEC1992	183.49	7.00	2.60
15DEC1992	183.47	7.00	2.52
16DEC1992	183.46	7.00	2.54
17DEC1992	183.51	7.00	2.54
18DEC1992	183.50	7.00	2.52
19DEC1992	183.48	7.00	2.51
20DEC1992	183.48	7.00	2.51
21DEC1992	183.49	7.00	2.51
22DEC1992	183.49	7.00	2.51
23DEC1992	183.49	7.00	2.51
24DEC1992	183.49	7.00	2.51
25DEC1992	183.50	7.00	2.51
26DEC1992	183.49	7.00	2.51
27DEC1992	183.49	7.00	2.51
28DEC1992	183.56	7.00	2.51
29DEC1992	183.59	7.00	2.52
30DEC1992	183.57	7.00	2.52
31DEC1992	183.55	7.00	2.51
01JAN1993	183.60	7.00	2.54
02JAN1993	183.60	7.00	2.55
03JAN1993	183.61	7.00	2.54
04JAN1993	183.55	7.00	2.52
05JAN1993	183.52	7.00	2.51
06JAN1993	183.57	7.00	2.54
07JAN1993	184.42	7.00	2.79
08JAN1993	184.85	7.00	2.91
09JAN1993	184.66	7.00	2.88
10JAN1993	184.93	7.00	2.94
11JAN1993	184.65	7.00	2.49
12JAN1993	184.85	7.00	2.96
13JAN1993	185.53	7.00	3.36
14JAN1993	185.51	7.00	3.24
15JAN1993	185.15	7.00	3.09
16JAN1993	184.90	7.00	3.00
17JAN1993	186.11	6.99	3.72
18JAN1993	185.53	6.99	3.30
19JAN1993	184.68	6.99	2.91
20JAN1993	184.23	6.99	2.79
21JAN1993	184.25	6.99	2.76
22JAN1993	184.11	6.99	2.73
23JAN1993	183.82	6.99	2.64
24JAN1993	183.60	6.99	2.58
25JAN1993	183.44	6.99	2.54
26JAN1993	183.36	6.99	2.49
27JAN1993	183.33	6.99	2.46
28JAN1993	183.31	6.99	2.45
29JAN1993	183.31	6.99	2.45
30JAN1993	183.31	6.99	2.43
31JAN1993	183.31	6.99	2.42
01FEB1993	183.31	6.99	2.40
02FEB1993	183.31	6.99	2.39
03FEB1993	183.32	6.99	2.40
04FEB1993	183.33	6.99	2.40
05FEB1993	183.52	6.99	2.45

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
06FEB1993	183.59	6.99	2.46
07FEB1993	183.57	6.99	2.52
08FEB1993	186.12	6.99	3.47
09FEB1993	185.64	6.99	3.36
10FEB1993	184.74	6.99	2.90
11FEB1993	184.29	6.99	2.72
12FEB1993	183.99	6.99	2.63
13FEB1993	183.77	6.99	2.55
14FEB1993	183.61	6.99	2.51
15FEB1993	183.53	6.99	2.45
16FEB1993	183.49	6.99	2.45
17FEB1993	183.49	6.99	2.43
18FEB1993	183.75	6.99	2.52
19FEB1993	184.28	6.99	2.64
20FEB1993	184.11	6.99	2.58
21FEB1993	183.94	6.99	2.54
22FEB1993	183.76	6.99	2.51
23FEB1993	184.15	6.99	2.63
24FEB1993	184.14	6.99	2.57
25FEB1993	184.01	6.99	2.52
26FEB1993	183.92	6.99	2.51
27FEB1993	183.86	6.99	2.49
28FEB1993	183.79	6.99	2.46
01MAR1993	183.74	6.99	2.45
02MAR1993	183.69	6.99	2.43
03MAR1993	183.66	6.99	2.42
04MAR1993	183.65	6.99	2.40
05MAR1993	183.61	6.99	2.39
06MAR1993	183.59	6.99	2.37
07MAR1993	183.62	6.99	2.33
08MAR1993	183.64	6.99	2.33
09MAR1993	183.63	6.99	2.33
10MAR1993	183.63	6.99	2.31
11MAR1993	183.64	6.99	2.30
12MAR1993	183.65	6.99	2.27
13MAR1993	183.68	6.99	2.27
14MAR1993	183.71	6.99	2.27
15MAR1993	183.68	6.99	2.25
16MAR1993	183.64	6.99	2.22
17MAR1993	183.63	6.99	2.22
18MAR1993	183.61	6.99	2.16
19MAR1993	183.59	6.99	2.15
20MAR1993	183.57	6.99	2.09
21MAR1993	183.57	6.99	2.04
22MAR1993	183.58	6.99	2.49
23MAR1993	184.17	6.99	2.51
24MAR1993	186.93	6.99	4.13
25MAR1993	188.01	6.99	4.79
26MAR1993	187.06	6.99	4.26
27MAR1993	186.21	6.99	3.78
28MAR1993	186.25	6.99	3.75
29MAR1993	186.21	6.99	4.14
30MAR1993	185.40	6.99	3.63
31MAR1993	185.31	6.99	3.54
01APR1993	185.41	6.99	3.59
02APR1993	185.27	6.99	3.53
03APR1993	184.86	6.99	3.17
04APR1993	185.28	6.99	3.45
05APR1993	185.49	6.99	3.60
06APR1993	186.39	6.99	4.26
07APR1993	186.69	6.99	4.44
08APR1993	187.09	6.99	4.49
09APR1993	187.48	6.99	5.01
10APR1993	187.21	6.99	4.79
11APR1993	187.26	6.99	4.76
12APR1993	187.27	6.99	4.71
13APR1993	187.16	6.99	4.67
14APR1993	187.93	6.99	5.10
15APR1993	187.97	6.99	5.22
16APR1993	187.99	6.99	5.19
17APR1993	188.69	6.99	5.49
18APR1993	188.68	6.99	5.58
19APR1993	188.37	6.99	5.46
20APR1993	188.58	6.99	5.48
21APR1993	188.77	6.99	5.52
22APR1993	188.89	6.99	5.64
23APR1993	189.10	6.99	5.67
24APR1993	189.37	6.99	5.88
25APR1993	189.37	6.99	5.91
26APR1993	188.86	6.99	5.75
27APR1993	188.84	6.99	5.55
28APR1993	189.12	6.99	5.82
29APR1993	189.22	6.99	5.88
30APR1993	189.18	6.99	5.91
01MAY1993	188.98	6.99	5.82
02MAY1993	188.79	6.99	5.66
03MAY1993	188.89	6.99	5.66
04MAY1993	188.92	6.99	5.75
05MAY1993	188.86	6.99	5.69
06MAY1993	188.95	6.99	5.72
07MAY1993	189.01	6.99	5.72
08MAY1993	189.17	6.99	5.81
09MAY1993	189.21	6.99	5.81
10MAY1993	189.17	6.99	5.82
11MAY1993	189.23	6.99	5.85
12MAY1993	189.15	6.99	5.81
13MAY1993	189.29	6.99	5.88
14MAY1993	189.37	6.99	5.91
15MAY1993	189.38	6.99	5.91
16MAY1993	189.37	6.99	5.91
17MAY1993	189.43	6.99	5.76
18MAY1993	189.27	6.99	5.82
19MAY1993	189.35	6.99	5.81
20MAY1993	189.63	6.99	5.88
21MAY1993	189.66	6.99	5.93
22MAY1993	189.77	6.99	5.96
23MAY1993	189.77	6.99	6.00
24MAY1993	189.64	6.99	6.00
25MAY1993	189.55	6.98	5.97
26MAY1993	189.46	6.98	5.91
27MAY1993	189.32	6.98	5.85
28MAY1993	189.15	6.98	5.79
29MAY1993	189.16	6.98	5.76
30MAY1993	189.14	6.98	5.76
31MAY1993	188.96	6.98	5.78
01JUN1993	188.82	6.98	5.72
02JUN1993	188.85	6.98	5.69
03JUN1993	188.84	6.98	5.69
04JUN1993	188.83	6.98	5.69
05JUN1993	188.79	6.97	5.67
06JUN1993	188.76	6.97	5.67
07JUN1993	188.69	6.97	5.63
08JUN1993	188.66	6.97	5.61
09JUN1993	188.75	6.97	5.60
10JUN1993	188.73	6.97	5.63
11JUN1993	188.69	6.97	5.63
12JUN1993	189.15	6.97	5.66
13JUN1993	189.45	6.97	5.85
14JUN1993	189.59	6.97	5.94
15JUN1993	189.69	6.97	6.03
16JUN1993	189.75	6.97	6.09

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
17JUN1993	189.87	6.97	6.15
18JUN1993	190.20	6.97	6.24
19JUN1993	190.38	6.97	6.41
20JUN1993	190.61	6.97	6.51
21JUN1993	190.93	6.97	6.65
22JUN1993	191.05	6.97	6.69
23JUN1993	191.01	6.97	6.72
24JUN1993	191.13	6.97	6.75
25JUN1993	191.10	6.97	6.77
26JUN1993	191.13	6.97	6.77
27JUN1993	191.15	6.97	6.78
28JUN1993	191.13	6.97	6.83
29JUN1993	191.18	6.97	6.81
30JUN1993	191.17	6.97	6.78
01JUL1993	191.23	6.97	6.80
02JUL1993	191.20	6.97	6.80
03JUL1993	191.25	6.97	6.80
04JUL1993	191.28	6.97	6.81
05JUL1993	191.29	6.97	6.83
06JUL1993	191.29	6.97	6.84
07JUL1993	191.23	6.97	6.83
08JUL1993	191.23	6.97	6.83
09JUL1993	191.23	6.97	6.81
10JUL1993	191.32	6.97	6.84
11JUL1993	191.36	6.97	6.90
12JUL1993	191.33	6.97	6.93
13JUL1993	191.21	6.97	6.89
14JUL1993	191.25	6.97	6.87
15JUL1993	191.26	6.97	6.87
16JUL1993	191.32	6.97	6.90
17JUL1993	191.37	6.97	6.95
18JUL1993	191.39	6.97	6.96
19JUL1993	191.35	6.97	6.95
20JUL1993	191.39	6.97	6.96
21JUL1993	191.49	6.97	6.96
22JUL1993	191.56	6.97	6.99
23JUL1993	191.49	6.97	7.02
24JUL1993	191.14	6.97	6.89
25JUL1993	191.04	6.97	6.78
26JUL1993	190.94	6.97	6.77
27JUL1993	191.04	6.97	6.72
28JUL1993	191.01	6.97	6.75
29JUL1993	191.08	6.97	6.77
30JUL1993	190.97	6.97	6.78
31JUL1993	190.96	6.97	6.75
01AUG1993	190.97	6.97	6.75
02AUG1993	190.92	6.97	6.77
03AUG1993	191.02	6.97	6.77
04AUG1993	190.97	6.97	6.81
05AUG1993	190.89	6.97	6.83
06AUG1993	190.69	6.97	6.69
07AUG1993	190.75	6.97	6.63
08AUG1993	190.87	6.97	6.71
09AUG1993	190.88	6.97	6.84
10AUG1993	190.91	6.97	6.87
11AUG1993	190.89	6.97	6.89
12AUG1993	190.76	6.97	6.72
13AUG1993	190.81	6.97	6.81
14AUG1993	190.96	6.97	6.89
15AUG1993	191.03	6.97	6.89
16AUG1993	190.77	6.97	-0.06
17AUG1993	190.32	6.97	-0.38
18AUG1993	190.14	6.97	-0.50
19AUG1993	190.02	6.97	-0.56
20AUG1993	189.80	6.97	-0.68
21AUG1993	189.63	6.97	-0.75
22AUG1993	189.53	6.97	-0.80
23AUG1993	189.39	6.97	-0.84
24AUG1993	189.25	6.97	-0.95
25AUG1993	189.44	6.97	-0.95
26AUG1993	189.42	6.97	0.06
27AUG1993	189.10	6.97	0.03
28AUG1993	188.95	6.97	-0.05
29AUG1993	188.91	6.97	-0.08
30AUG1993	188.93	6.97	-0.08
31AUG1993	188.82	6.97	-0.06
01SEP1993	188.42	6.97	-0.23
02SEP1993	188.29	6.97	-0.38
03SEP1993	188.29	6.97	-0.41
04SEP1993	188.26	6.97	-0.41
05SEP1993	188.29	6.97	-0.41
06SEP1993	188.67	6.97	-0.30
07SEP1993	188.71	6.97	-0.21
08SEP1993	188.74	6.97	0.01
09SEP1993	188.88	6.97	5.91
10SEP1993	188.95	6.97	0.06
11SEP1993	188.97	6.97	0.04
12SEP1993	188.98	6.97	0.03
13SEP1993	188.82	6.97	-0.02
14SEP1993	188.75	6.97	-0.06
15SEP1993	188.67	6.97	-0.05
16SEP1993	188.53	6.97	0.00
17SEP1993	188.46	6.97	-0.03
18SEP1993	188.45	6.97	-0.02
19SEP1993	188.35	6.97	-0.03
20SEP1993	188.29	6.97	-0.03
21SEP1993	188.27	6.97	-0.05
22SEP1993	188.33	6.97	0.00
23SEP1993	188.33	6.97	0.00
24SEP1993	188.13	6.97	-0.08
25SEP1993	188.13	6.97	0.00
26SEP1993	188.19	6.97	0.01
27SEP1993	188.24	6.97	0.00
28SEP1993	188.29	6.97	0.00
29SEP1993	188.42	6.97	0.00
30SEP1993	188.37	6.97	5.49
01OCT1993	188.30	6.97	5.49
02OCT1993	188.24	6.97	0.00
03OCT1993	188.23	6.97	0.00
04OCT1993	188.23	6.97	-0.02
05OCT1993	188.24	6.97	0.00
06OCT1993	188.22	6.97	0.00
07OCT1993	188.14	6.97	0.00
08OCT1993	187.91	6.97	-0.05
09OCT1993	188.02	6.97	-0.03
10OCT1993	188.05	6.97	-0.05
11OCT1993	188.02	6.97	M
12OCT1993	188.00	6.97	-0.02
13OCT1993	188.04	6.97	0.00
14OCT1993	187.92	6.97	-0.02
15OCT1993	187.51	6.97	-0.09
16OCT1993	187.73	6.97	-0.06
17OCT1993	188.04	6.97	-0.02
18OCT1993	188.08	6.97	0.01
19OCT1993	188.13	6.97	0.01
20OCT1993	188.11	6.97	0.01
21OCT1993	188.09	6.97	0.01
22OCT1993	188.08	6.97	0.00
23OCT1993	M	M	0.00
24OCT1993	M	M	0.01
25OCT1993	M	M	0.01

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
26OCT1993	M	M	0.00
27OCT1993	M	M	0.00
28OCT1993	M	M	0.00
29OCT1993	M	M	0.01
30OCT1993	M	M	0.04
31OCT1993	M	M	0.01
01NOV1993	M	M	-0.33
02NOV1993	M	M	-0.03
03NOV1993	M	M	-0.21
04NOV1993	M	M	-0.02
05NOV1993	M	M	0.00
06NOV1993	M	M	-0.09
07NOV1993	M	M	-0.06
08NOV1993	M	M	0.00
09NOV1993	M	M	0.00
10NOV1993	M	M	-0.06
11NOV1993	M	M	0.00
12NOV1993	M	M	-0.02
13NOV1993	M	M	-0.06
14NOV1993	M	M	-0.09
15NOV1993	M	M	-0.03
16NOV1993	M	M	-0.06
17NOV1993	M	M	-0.03
18NOV1993	M	M	-0.06
19NOV1993	M	M	-0.02
20NOV1993	M	M	-0.05
21NOV1993	M	M	-0.02
22NOV1993	M	M	-0.06
23NOV1993	M	M	-0.08
24NOV1993	M	M	-0.03
25NOV1993	M	M	-0.05
26NOV1993	M	M	-0.03
27NOV1993	M	M	-0.05
28NOV1993	M	M	-0.08
29NOV1993	M	M	-0.11
30NOV1993	M	M	-0.11
01DEC1993	M	M	-0.11
02DEC1993	M	M	-0.11
03DEC1993	M	M	-0.11
04DEC1993	M	M	-0.11
05DEC1993	M	M	-0.11
06DEC1993	M	M	-0.11
07DEC1993	M	M	-0.11
08DEC1993	M	M	-0.11
09DEC1993	M	M	-0.11
10DEC1993	M	M	-0.11
11DEC1993	M	M	-0.11
12DEC1993	M	M	-0.11
13DEC1993	M	M	-0.11
14DEC1993	M	M	-0.11
15DEC1993	M	M	-0.11
16DEC1993	M	M	-0.11
17DEC1993	M	M	-0.11
18DEC1993	M	M	-0.11
19DEC1993	M	M	-0.11
20DEC1993	M	M	-0.11
21DEC1993	M	M	-0.11
22DEC1993	M	M	-0.11
23DEC1993	M	M	-0.11
24DEC1993	M	M	-0.11
25DEC1993	M	M	-0.11
26DEC1993	M	M	-0.11
27DEC1993	M	M	-0.11
28DEC1993	M	M	-0.11
29DEC1993	M	M	-0.11
30DEC1993	M	M	-0.11
31DEC1993	M	M	-0.11
01JAN1994	M	M	0.19
02JAN1994	M	M	0.19
03JAN1994	M	M	0.19
04JAN1994	M	M	0.19
05JAN1994	M	M	0.21
06JAN1994	M	M	0.21
07JAN1994	M	M	M
08JAN1994	M	M	0.21
09JAN1994	M	M	0.21
10JAN1994	M	M	0.22
11JAN1994	M	M	0.22
12JAN1994	M	M	0.24
13JAN1994	M	M	0.24
14JAN1994	M	M	0.24
15JAN1994	M	M	0.24
16JAN1994	M	M	0.24
17JAN1994	M	M	0.25
18JAN1994	M	M	0.25
19JAN1994	M	M	0.25
20JAN1994	M	M	0.24
21JAN1994	M	M	0.24
22JAN1994	M	M	0.24
23JAN1994	M	M	0.30
24JAN1994	M	M	0.42
25JAN1994	M	M	0.48
26JAN1994	M	M	0.51
27JAN1994	M	M	0.49
28JAN1994	M	M	0.48
29JAN1994	M	M	0.45
30JAN1994	M	M	0.43
31JAN1994	M	M	0.40
01FEB1994	M	M	0.37
02FEB1994	M	M	0.36
03FEB1994	M	M	0.33
04FEB1994	M	M	0.31
05FEB1994	M	M	0.30
06FEB1994	M	M	0.27
07FEB1994	M	M	0.25
08FEB1994	M	M	1.14
09FEB1994	M	M	M
10FEB1994	M	M	M
11FEB1994	M	M	M
12FEB1994	M	M	M
13FEB1994	M	M	M
14FEB1994	M	M	M
15FEB1994	M	M	M
16FEB1994	M	M	M
17FEB1994	M	M	M
18FEB1994	M	M	M
19FEB1994	M	M	0.00
20FEB1994	M	M	M
21FEB1994	M	M	M
22FEB1994	M	M	M
23FEB1994	M	M	M
24FEB1994	M	M	M
25FEB1994	M	M	M
26FEB1994	M	M	M
27FEB1994	M	M	M
28FEB1994	M	M	M
01MAR1994	183.13	6.97	3.30
02MAR1994	183.12	6.97	3.25
03MAR1994	183.12	6.97	3.22
04MAR1994	183.12	6.97	3.19

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
05MAR1994	183.38	6.97	3.15
06MAR1994	183.25	6.97	3.12
07MAR1994	183.20	6.97	3.06
08MAR1994	183.17	6.97	2.94
09MAR1994	183.19	6.97	M
10MAR1994	183.25	6.97	M
11MAR1994	186.51	6.97	3.03
12MAR1994	187.37	6.97	4.09
13MAR1994	187.23	6.97	4.51
14MAR1994	187.24	6.97	4.59
15MAR1994	187.58	6.97	4.71
16MAR1994	187.91	6.97	4.83
17MAR1994	187.97	6.97	4.99
18MAR1994	188.25	6.97	5.01
19MAR1994	188.46	6.97	5.08
20MAR1994	188.85	6.97	5.13
21MAR1994	189.45	6.97	5.41
22MAR1994	189.48	6.97	5.53
23MAR1994	189.76	6.97	5.55
24MAR1994	190.00	6.97	5.76
25MAR1994	189.73	6.97	5.70
26MAR1994	189.62	6.97	5.65
27MAR1994	189.22	6.97	5.50
28MAR1994	189.52	6.97	5.49
29MAR1994	189.61	6.97	5.65
30MAR1994	189.56	6.97	5.64
31MAR1994	189.40	6.97	5.61
01APR1994	189.32	6.97	5.53
02APR1994	189.42	6.97	5.53
03APR1994	189.38	6.97	5.56
04APR1994	189.41	6.97	5.53
05APR1994	189.32	6.97	5.56
06APR1994	189.33	6.97	5.58
07APR1994	189.09	6.97	5.52
08APR1994	189.13	6.97	5.50
09APR1994	189.13	6.97	5.55
10APR1994	189.07	6.97	5.55
11APR1994	189.03	6.97	5.55
12APR1994	189.06	6.97	5.52
13APR1994	189.07	6.97	5.52
14APR1994	189.09	6.97	5.50
15APR1994	189.28	6.97	5.47
16APR1994	189.24	6.97	5.49
17APR1994	189.31	6.97	5.50
18APR1994	189.22	6.97	5.52
19APR1994	189.11	6.97	5.49
20APR1994	189.24	6.97	5.49
21APR1994	189.25	6.97	5.55
22APR1994	189.11	6.97	5.55
23APR1994	189.08	6.97	5.49
24APR1994	188.95	6.97	5.50
25APR1994	188.82	6.96	5.47
26APR1994	188.66	6.96	5.41
27APR1994	187.89	6.96	5.25
28APR1994	187.45	6.96	5.17
29APR1994	187.17	6.96	5.05
30APR1994	187.08	6.96	4.98
01MAY1994	187.02	6.96	4.89
02MAY1994	187.10	6.96	4.77
03MAY1994	187.09	6.96	4.71
04MAY1994	187.58	6.96	4.65
05MAY1994	188.25	6.96	4.69
06MAY1994	188.65	6.96	5.08
07MAY1994	188.06	6.96	5.20
08MAY1994	187.64	6.96	4.83
09MAY1994	187.58	6.96	4.74
10MAY1994	187.61	6.96	4.75
11MAY1994	187.64	6.96	4.74
12MAY1994	187.91	6.96	4.75
13MAY1994	188.27	6.96	4.95
14MAY1994	188.49	6.96	5.10
15MAY1994	188.80	6.96	5.23
16MAY1994	188.80	6.96	5.34
17MAY1994	188.54	6.96	5.34
18MAY1994	187.80	6.96	4.95
19MAY1994	187.32	6.96	4.63
20MAY1994	187.20	6.96	4.53
21MAY1994	187.17	6.96	4.51
22MAY1994	187.44	6.96	4.51
23MAY1994	187.77	6.96	4.62
24MAY1994	188.67	6.96	5.02
25MAY1994	189.02	6.96	5.49
26MAY1994	189.35	6.96	5.58
27MAY1994	189.52	6.96	5.76
28MAY1994	189.48	6.96	5.76
29MAY1994	189.93	6.96	5.88
30MAY1994	189.87	6.96	5.91
31MAY1994	189.93	6.96	5.88
01JUN1994	190.00	6.96	5.88
02JUN1994	190.12	6.96	5.92
03JUN1994	190.07	6.96	6.03
04JUN1994	190.14	6.96	6.01
05JUN1994	190.23	6.96	6.09
06JUN1994	190.30	6.96	6.07
07JUN1994	190.18	6.96	6.18
08JUN1994	190.02	6.96	6.06
09JUN1994	189.96	6.96	6.01
10JUN1994	190.19	6.96	6.09
11JUN1994	190.23	6.96	6.19
12JUN1994	190.31	6.96	6.18
13JUN1994	190.45	6.96	6.25
14JUN1994	190.41	6.96	6.30
15JUN1994	190.49	6.96	6.36
16JUN1994	190.57	6.96	6.43
17JUN1994	190.59	6.96	6.48
18JUN1994	190.50	6.96	6.45
19JUN1994	190.66	6.96	6.43
20JUN1994	191.63	6.96	6.61
21JUN1994	192.39	6.96	7.15
22JUN1994	192.79	6.96	7.39
23JUN1994	192.29	6.96	7.35
24JUN1994	192.28	6.96	7.26
25JUN1994	192.33	6.96	7.30
26JUN1994	192.41	6.96	7.33
27JUN1994	192.29	6.96	7.38
28JUN1994	191.68	6.96	7.27
29JUN1994	190.94	6.96	6.67
30JUN1994	190.83	6.96	6.61
01JUL1994	190.88	6.96	6.58
02JUL1994	191.01	6.96	6.72
03JUL1994	191.02	6.96	6.73
04JUL1994	191.10	6.96	6.72
05JUL1994	191.09	6.96	6.75
06JUL1994	191.09	6.96	6.75
07JUL1994	191.18	6.96	6.78
08JUL1994	191.08	6.96	6.76
09JUL1994	191.11	6.96	6.72
10JUL1994	191.09	6.96	6.72
11JUL1994	191.21	6.96	6.73
12JUL1994	191.34	6.96	6.85
13JUL1994	191.37	6.96	6.88
14JUL1994	191.38	6.96	6.87

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
15JUL1994	191.43	6.96	6.87
16JUL1994	191.59	6.96	6.91
17JUL1994	191.68	6.96	6.88
18JUL1994	191.77	6.96	6.85
19JUL1994	191.88	6.96	6.90
20JUL1994	191.93	6.96	6.90
21JUL1994	191.81	6.96	6.94
22JUL1994	191.73	6.96	6.87
23JUL1994	191.78	6.96	6.90
24JUL1994	191.73	6.96	6.93
25JUL1994	191.72	6.96	6.88
26JUL1994	191.67	6.96	6.96
27JUL1994	191.57	6.96	6.87
28JUL1994	191.52	6.96	6.90
29JUL1994	191.47	6.96	6.82
30JUL1994	191.46	6.96	6.87
31JUL1994	191.33	6.96	6.90
01AUG1994	191.16	6.96	6.79
02AUG1994	191.21	6.96	6.73
03AUG1994	191.28	6.96	6.75
04AUG1994	191.34	6.96	6.81
05AUG1994	191.16	6.96	6.61
06AUG1994	191.20	6.96	6.60
07AUG1994	191.05	6.96	6.60
08AUG1994	190.92	6.96	6.51
09AUG1994	190.59	6.96	6.36
10AUG1994	190.69	6.96	6.30
11AUG1994	190.76	6.96	6.28
12AUG1994	190.99	6.96	6.27
13AUG1994	191.27	6.96	6.36
14AUG1994	191.48	6.96	6.34
15AUG1994	191.70	6.96	6.34
16AUG1994	191.85	6.96	6.36
17AUG1994	191.83	6.96	6.39
18AUG1994	191.77	6.96	6.42
19AUG1994	191.69	6.96	6.43
20AUG1994	191.49	6.96	6.39
21AUG1994	191.35	6.96	6.37
22AUG1994	191.19	6.96	6.34
23AUG1994	191.14	6.96	6.31
24AUG1994	190.57	6.96	6.39
25AUG1994	190.34	6.96	6.31
26AUG1994	190.28	6.96	6.27
27AUG1994	190.25	6.96	6.24
28AUG1994	190.22	6.96	6.21
29AUG1994	190.20	6.96	6.21
30AUG1994	189.98	6.96	6.22
31AUG1994	189.82	6.96	6.13
01SEP1994	189.71	6.96	6.12
02SEP1994	189.73	6.96	6.12
03SEP1994	189.69	6.96	6.09
04SEP1994	189.69	6.96	6.06
05SEP1994	189.52	6.96	6.03
06SEP1994	189.33	6.96	5.91
07SEP1994	189.16	6.96	5.82
08SEP1994	188.88	6.96	5.73
09SEP1994	188.87	6.96	5.70
10SEP1994	188.81	6.96	5.70
11SEP1994	188.81	6.96	5.70
12SEP1994	188.73	6.96	5.70
13SEP1994	188.90	6.96	5.71
14SEP1994	188.88	6.96	5.71
15SEP1994	188.58	6.96	5.58
16SEP1994	188.38	6.96	5.44
17SEP1994	188.35	6.96	5.37
18SEP1994	188.21	6.96	5.32
19SEP1994	188.14	6.96	5.28
20SEP1994	188.14	6.96	5.29
21SEP1994	188.15	6.96	5.31
22SEP1994	188.14	6.96	5.34
23SEP1994	188.06	6.96	5.28
24SEP1994	187.77	6.96	5.11
25SEP1994	187.67	6.96	5.07
26SEP1994	187.69	6.96	5.10
27SEP1994	187.68	6.96	5.10
28SEP1994	187.72	6.94	5.16
29SEP1994	188.25	6.94	5.40
30SEP1994	188.23	6.94	5.43
01OCT1994	187.88	6.94	5.19
02OCT1994	187.60	6.94	5.04
03OCT1994	187.37	6.94	4.87
04OCT1994	187.43	6.93	4.83
05OCT1994	187.46	6.93	4.90
06OCT1994	186.89	6.93	4.53
07OCT1994	186.67	6.93	4.41
08OCT1994	186.57	6.93	4.33
09OCT1994	186.51	6.93	4.29
10OCT1994	186.74	6.93	4.35
11OCT1994	186.98	6.93	4.50
12OCT1994	186.99	6.93	4.56
13OCT1994	187.02	6.93	4.59
14OCT1994	187.13	6.93	4.63
15OCT1994	187.23	6.93	4.56
16OCT1994	187.34	6.93	4.62
17OCT1994	187.38	6.93	4.57
18OCT1994	187.43	6.93	4.62
19OCT1994	187.65	6.93	4.68
20OCT1994	187.88	6.93	4.86
21OCT1994	188.07	6.93	4.92
22OCT1994	188.24	6.93	4.98
23OCT1994	188.37	6.93	5.01
24OCT1994	188.67	6.93	5.11
25OCT1994	189.56	6.93	5.58
26OCT1994	189.74	6.93	5.77
27OCT1994	189.71	6.93	5.71
28OCT1994	189.69	6.93	5.68
29OCT1994	189.67	6.93	5.65
30OCT1994	189.60	6.93	5.62
31OCT1994	189.65	6.93	5.61
01NOV1994	186.54	6.93	4.32
02NOV1994	184.46	6.93	3.13
03NOV1994	183.81	6.93	2.80
04NOV1994	183.63	6.93	2.67
05NOV1994	183.58	6.93	2.62
06NOV1994	183.54	6.93	2.61
07NOV1994	183.57	6.93	2.59
08NOV1994	183.52	6.93	2.59
09NOV1994	183.59	6.93	2.62
10NOV1994	183.52	6.93	2.59
11NOV1994	183.48	6.93	2.56
12NOV1994	183.45	6.93	2.53
13NOV1994	183.44	6.93	2.52
14NOV1994	183.42	6.93	2.52
15NOV1994	183.49	6.93	2.56
16NOV1994	183.45	6.93	2.55
17NOV1994	183.45	6.93	2.53
18NOV1994	183.38	6.93	2.53
19NOV1994	183.37	6.93	2.49
20NOV1994	183.38	6.93	2.52
21NOV1994	183.37	6.93	2.53
22NOV1994	183.38	6.93	2.53

MIDNIGHT READINGS

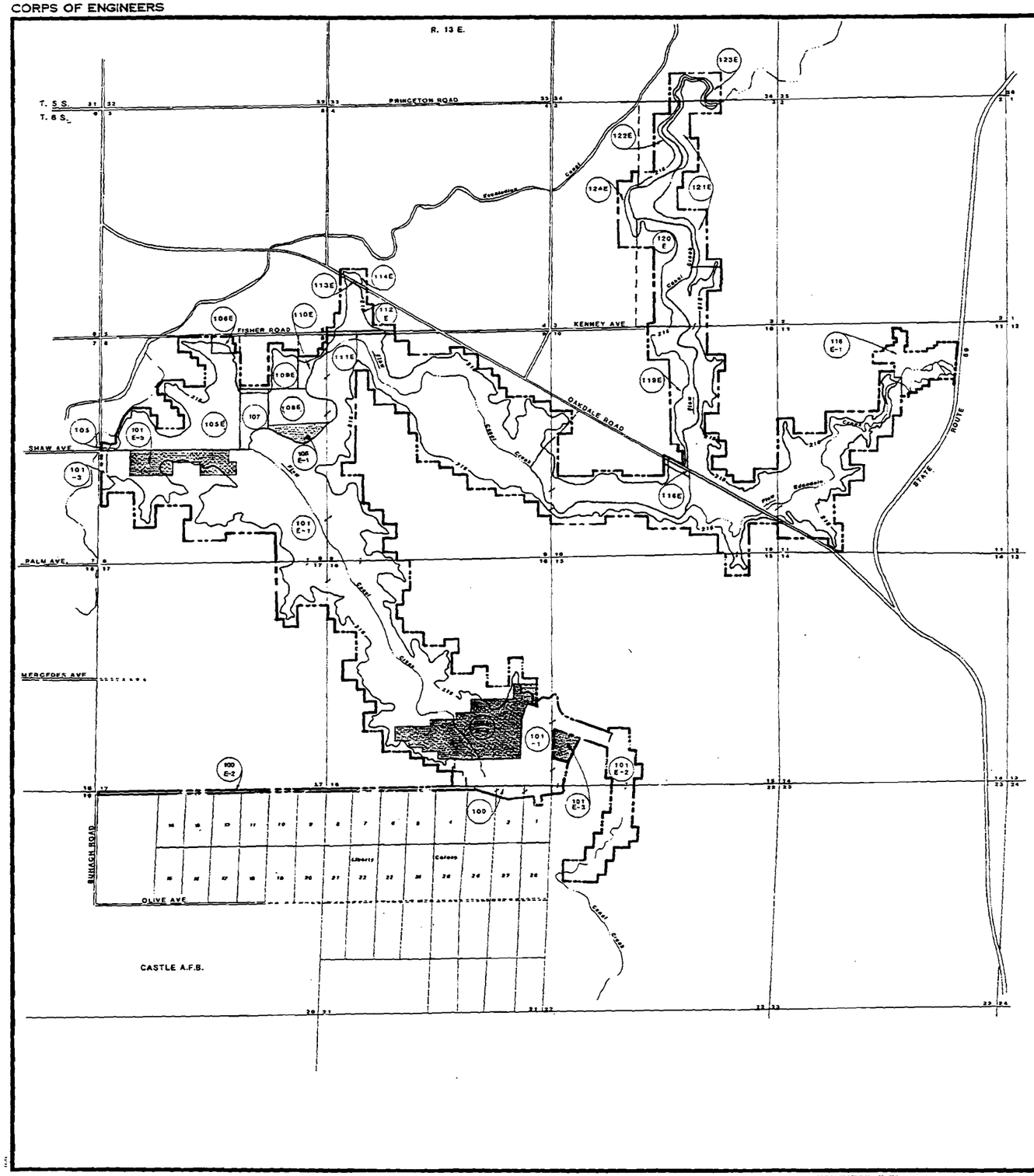
DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
23NOV1994	183.37	6.93	2.53
24NOV1994	183.37	6.93	2.55
25NOV1994	183.46	6.93	2.59
26NOV1994	183.41	6.93	2.64
27NOV1994	183.37	6.93	2.59
28NOV1994	183.35	6.93	2.62
29NOV1994	183.33	6.93	2.62
30NOV1994	183.33	6.93	2.64
01DEC1994	183.33	6.93	2.64
02DEC1994	183.33	6.93	2.64
03DEC1994	183.33	6.93	2.64
04DEC1994	183.33	6.93	2.64
05DEC1994	183.33	6.93	2.64
06DEC1994	183.33	6.93	2.64
07DEC1994	183.33	6.93	2.64
08DEC1994	183.33	6.93	2.64
09DEC1994	183.33	6.93	2.64
10DEC1994	183.33	6.93	2.64
11DEC1994	183.33	6.93	2.64
12DEC1994	183.33	6.93	2.64
13DEC1994	183.33	6.93	2.64
14DEC1994	183.33	6.93	2.64
15DEC1994	183.33	6.93	2.64
16DEC1994	183.33	6.93	2.64
17DEC1994	183.33	6.93	2.64
18DEC1994	183.33	6.93	2.64
19DEC1994	183.33	6.93	2.64
20DEC1994	183.33	6.93	2.64
21DEC1994	183.33	6.93	2.64
22DEC1994	183.33	6.93	2.64
23DEC1994	183.33	6.93	2.64
24DEC1994	183.33	6.93	2.64
25DEC1994	183.33	6.93	2.64
26DEC1994	183.33	6.93	2.64
27DEC1994	183.33	6.93	2.64
28DEC1994	183.33	6.93	2.64
29DEC1994	183.33	6.93	2.64
30DEC1994	183.33	6.93	2.64
31DEC1994	183.33	6.93	2.64
01JAN1995	M	M	2.35
02JAN1995	M	M	2.35
03JAN1995	M	M	2.40
04JAN1995	M	M	2.61
05JAN1995	M	M	2.74
06JAN1995	M	M	2.65
07JAN1995	M	M	2.53
08JAN1995	M	M	2.41
09JAN1995	M	M	2.40
10JAN1995	M	M	3.24
11JAN1995	M	M	2.55
12JAN1995	M	M	2.53
13JAN1995	M	M	2.32
14JAN1995	M	M	2.77
15JAN1995	M	M	2.85
16JAN1995	187.22	0.00	2.82
17JAN1995	187.02	0.00	2.73
18JAN1995	186.78	0.00	2.64
19JAN1995	186.60	0.00	2.53
20JAN1995	186.47	0.00	2.47
21JAN1995	186.36	0.00	2.43
22JAN1995	186.34	0.00	2.44
23JAN1995	186.59	0.00	2.56
24JAN1995	188.98	0.00	3.49
25JAN1995	191.31	0.00	3.34
26JAN1995	191.84	0.00	3.43
27JAN1995	194.83	0.00	3.88
28JAN1995	195.67	0.00	3.69
29JAN1995	195.05	0.00	3.58
30JAN1995	194.23	0.00	3.52
31JAN1995	193.10	0.33	3.91
01FEB1995	189.63	2.01	5.02
02FEB1995	185.18	2.01	3.45
03FEB1995	183.69	2.01	2.65
04FEB1995	183.37	2.01	2.47
05FEB1995	183.30	2.01	2.40
06FEB1995	183.30	2.01	2.35
07FEB1995	183.22	2.01	2.31
08FEB1995	183.37	2.01	2.25
09FEB1995	183.22	2.01	2.17
10FEB1995	183.16	2.01	2.16
11FEB1995	183.16	2.01	2.16
12FEB1995	183.16	2.01	2.14
13FEB1995	183.16	2.01	2.19
14FEB1995	183.26	2.01	2.13
15FEB1995	183.16	2.01	2.13
16FEB1995	183.16	2.01	2.13
17FEB1995	183.16	2.01	2.13
18FEB1995	183.16	2.01	2.11
19FEB1995	183.16	2.01	2.08
20FEB1995	183.32	2.01	2.37
21FEB1995	183.32	2.01	2.43
22FEB1995	183.22	2.01	2.37
23FEB1995	183.15	2.01	2.29
24FEB1995	183.15	2.01	2.26
25FEB1995	183.14	2.01	2.29
26FEB1995	183.14	2.01	2.27
27FEB1995	183.14	2.01	2.23
28FEB1995	183.14	2.01	2.27
01MAR1995	183.14	2.01	2.12
02MAR1995	183.14	2.01	2.09
03MAR1995	183.14	2.01	2.14
04MAR1995	183.14	2.01	2.15
05MAR1995	183.13	2.01	2.12
06MAR1995	183.13	2.01	2.11
07MAR1995	183.13	2.01	2.08
08MAR1995	183.13	2.01	2.08
09MAR1995	183.19	2.01	2.45
10MAR1995	193.70	0.05	4.55
11MAR1995	196.83	0.05	4.00
12MAR1995	196.04	0.05	3.77
13MAR1995	195.09	0.05	3.61
14MAR1995	194.11	0.05	3.53
15MAR1995	193.02	0.05	3.47
16MAR1995	191.87	0.05	3.40
17MAR1995	190.69	0.05	3.29
18MAR1995	189.52	0.05	3.17
19MAR1995	188.45	0.05	2.99
20MAR1995	187.82	0.05	2.92
21MAR1995	188.07	0.05	2.87
22MAR1995	188.03	0.05	3.07
23MAR1995	192.12	0.05	3.44
24MAR1995	191.38	0.05	3.35
25MAR1995	190.23	0.05	3.25
26MAR1995	189.08	0.05	3.11
27MAR1995	188.11	0.05	2.89
28MAR1995	187.46	0.05	2.69
29MAR1995	187.19	0.05	2.56
30MAR1995	186.95	0.05	2.45
31MAR1995	186.67	0.05	2.39
01APR1995	186.48	0.05	2.33

MIDNIGHT READINGS

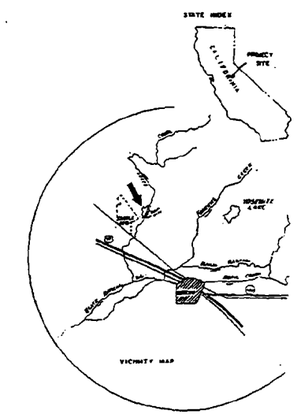
DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
02APR1995	186.33	0.05	2.29
03APR1995	186.20	0.05	2.26
04APR1995	186.12	0.05	2.20
05APR1995	186.05	0.05	2.14
06APR1995	185.78	6.81	3.04
07APR1995	185.13	6.81	2.44
08APR1995	184.96	6.81	3.37
09APR1995	187.78	6.81	4.75
10APR1995	187.81	6.81	4.79
11APR1995	187.56	6.81	4:67
12APR1995	187.64	6.81	4.67
13APR1995	188.57	6.81	5.21
14APR1995	188.63	6.81	5.27
15APR1995	188.76	6.81	5.36
16APR1995	188.96	6.81	5.45
17APR1995	188.69	6.81	5.38
18APR1995	188.14	6.81	5.02
19APR1995	188.07	6.81	4.99
20APR1995	188.07	6.81	5.02
21APR1995	188.05	6.81	4.99
22APR1995	188.09	6.81	5.02
23APR1995	188.20	6.81	5.11
24APR1995	187.99	6.81	4.96
25APR1995	188.00	6.81	4.97
26APR1995	188.26	6.81	5.05
27APR1995	188.92	6.81	5.47
28APR1995	189.13	6.81	5.57
29APR1995	189.24	6.81	5.69
30APR1995	188.56	6.81	5.24
01MAY1995	188.30	6.81	5.06
02MAY1995	188.29	6.81	5.06
03MAY1995	188.23	6.81	5.03
04MAY1995	188.11	6.81	4.93
05MAY1995	188.27	6.81	5.05
06MAY1995	188.29	6.81	5.05
07MAY1995	188.35	6.81	5.09
08MAY1995	188.33	6.81	5.06
09MAY1995	188.86	6.81	5.39
10MAY1995	188.93	6.81	5.45
11MAY1995	189.02	6.81	5.50
12MAY1995	188.92	6.81	5.44
13MAY1995	189.04	6.81	5.50
14MAY1995	188.97	6.81	5.47
15MAY1995	189.03	6.81	5.50
16MAY1995	189.09	6.81	5.54
17MAY1995	189.11	6.81	5.54
18MAY1995	189.21	6.81	5.60
19MAY1995	188.95	6.81	5.45
20MAY1995	188.93	6.81	5.47
21MAY1995	189.07	6.81	5.51
22MAY1995	189.01	6.81	5.50
23MAY1995	189.37	6.81	5.66
24MAY1995	189.51	6.81	5.75
25MAY1995	189.54	6.81	5.78
26MAY1995	189.54	6.81	5.81
27MAY1995	189.17	6.81	5.59
28MAY1995	189.25	6.81	5.63
29MAY1995	189.49	6.81	5.74
30MAY1995	189.75	6.81	5.89
31MAY1995	189.96	6.81	5.99
01JUN1995	190.09	6.81	6.04
02JUN1995	190.27	6.81	6.22
03JUN1995	190.35	6.81	6.25
04JUN1995	190.37	6.81	6.25
05JUN1995	190.35	6.81	6.26
06JUN1995	190.36	6.81	6.23
07JUN1995	190.43	6.81	6.28
08JUN1995	190.53	6.81	6.34
09JUN1995	190.50	6.81	6.32
10JUN1995	190.40	6.81	6.26
11JUN1995	190.40	6.81	6.28
12JUN1995	190.58	6.81	6.34
13JUN1995	190.77	6.81	6.41
14JUN1995	190.87	6.81	6.47
15JUN1995	191.03	6.80	6.52
16JUN1995	191.02	6.80	6.59
17JUN1995	190.54	6.80	6.37
18JUN1995	190.55	6.80	6.32
19JUN1995	190.45	6.80	6.25
20JUN1995	190.50	6.80	6.28
21JUN1995	190.39	6.80	6.23
22JUN1995	190.55	6.80	6.25
23JUN1995	191.53	6.80	6.56
24JUN1995	192.10	6.80	6.95
25JUN1995	192.37	6.80	7.07
26JUN1995	192.52	6.80	7.13
27JUN1995	192.77	6.80	7.19
28JUN1995	192.91	6.80	7.24
29JUN1995	192.07	6.80	7.01
30JUN1995	191.55	6.80	6.59
01JUL1995	191.54	6.80	6.83
02JUL1995	191.53	6.80	6.58
03JUL1995	191.57	6.80	6.49
04JUL1995	191.47	6.80	6.52
05JUL1995	191.33	6.80	6.49
06JUL1995	191.23	6.80	6.47
07JUL1995	191.49	6.80	6.88
08JUL1995	191.52	6.80	6.73
09JUL1995	191.54	6.80	6.85
10JUL1995	191.60	6.80	6.89
11JUL1995	191.59	6.80	6.94
12JUL1995	191.67	6.80	6.94
13JUL1995	191.71	6.80	6.95
14JUL1995	191.66	6.80	6.91
15JUL1995	191.73	6.80	6.97
16JUL1995	191.65	6.80	6.89
17JUL1995	191.64	6.80	6.92
18JUL1995	191.61	6.80	6.91
19JUL1995	191.57	6.80	6.86
20JUL1995	191.62	6.80	6.85
21JUL1995	191.57	6.80	6.82
22JUL1995	191.60	6.80	6.79
23JUL1995	191.51	6.80	6.76
24JUL1995	191.43	6.80	6.65
25JUL1995	191.60	6.80	6.73
26JUL1995	191.69	6.80	6.76
27JUL1995	191.53	6.80	6.73
28JUL1995	191.49	6.80	6.70
29JUL1995	191.42	6.80	6.65
30JUL1995	191.37	6.80	6.64
31JUL1995	191.35	6.80	6.59
01AUG1995	191.39	6.80	6.59
02AUG1995	191.39	6.80	6.62
03AUG1995	191.33	6.80	6.58
04AUG1995	191.30	6.80	6.56
05AUG1995	191.36	6.80	6.58
06AUG1995	191.31	6.80	6.58
07AUG1995	191.26	6.80	6.53
08AUG1995	191.27	6.80	6.55
09AUG1995	191.16	6.80	6.53
10AUG1995	190.99	6.80	6.46

MIDNIGHT READINGS

DATE	CTL Pool Elev (Feet)	CTL Gate Opening (Feet)	CCL Stream Stage (Feet)
11AUG1995	190.88	6.80	6.32
12AUG1995	190.89	6.80	6.29
13AUG1995	190.85	6.80	6.25
14AUG1995	190.79	6.80	6.25
15AUG1995	190.65	6.80	6.17
16AUG1995	190.51	6.80	6.08
17AUG1995	190.92	6.80	6.16
18AUG1995	191.16	6.80	6.31
19AUG1995	190.98	6.80	6.31
20AUG1995	191.20	6.80	6.37
21AUG1995	191.24	6.80	6.43
22AUG1995	191.40	6.80	6.50
23AUG1995	191.51	6.80	6.55
24AUG1995	191.62	6.80	6.61
25AUG1995	191.46	6.80	6.61
26AUG1995	191.30	6.80	6.58
27AUG1995	191.36	6.80	6.58
28AUG1995	191.33	6.80	6.61
29AUG1995	191.29	6.80	6.62
30AUG1995	191.23	6.80	6.64
31AUG1995	191.18	6.80	6.64
01SEP1995	191.09	6.80	6.61
02SEP1995	191.02	6.80	6.56
03SEP1995	191.00	6.80	6.55
04SEP1995	191.14	6.80	6.53
05SEP1995	191.08	6.80	6.58
06SEP1995	191.03	6.80	6.59
07SEP1995	190.97	6.80	6.55
08SEP1995	191.08	6.80	6.53
09SEP1995	191.09	6.80	6.53
10SEP1995	190.89	6.80	6.52
11SEP1995	190.55	6.80	6.35
12SEP1995	190.77	6.80	6.35
13SEP1995	190.30	6.80	6.29
14SEP1995	190.26	6.80	6.23
15SEP1995	190.16	6.80	6.20
16SEP1995	190.19	6.80	6.17
17SEP1995	190.20	6.80	6.17
18SEP1995	190.17	6.80	6.17
19SEP1995	190.17	6.80	6.17
20SEP1995	190.19	6.80	6.19
21SEP1995	189.94	6.80	6.16
22SEP1995	189.77	6.80	6.07
23SEP1995	189.79	6.80	6.01
24SEP1995	189.79	6.80	5.99
25SEP1995	189.55	6.80	5.96
26SEP1995	189.61	6.80	5.93
27SEP1995	189.63	6.80	5.92
28SEP1995	189.61	6.80	5.92
29SEP1995	189.61	6.80	5.93
30SEP1995	189.36	6.80	5.86
01OCT1995	189.35	6.80	5.80
02OCT1995	189.29	6.80	5.78
03OCT1995	189.33	6.80	5.78
04OCT1995	189.33	6.80	5.78
05OCT1995	188.93	6.80	5.75
06OCT1995	188.84	6.80	5.65
07OCT1995	188.86	6.80	5.62
08OCT1995	188.87	6.80	5.59
09OCT1995	188.71	6.80	5.59
10OCT1995	188.54	6.80	5.50
11OCT1995	188.62	6.80	5.45
12OCT1995	188.63	6.80	5.45
13OCT1995	188.75	6.80	5.47
14OCT1995	188.67	6.80	5.48
15OCT1995	188.72	6.80	5.47
16OCT1995	188.79	6.80	5.50
17OCT1995	188.73	6.80	5.53
18OCT1995	187.91	6.80	5.33
19OCT1995	187.94	6.80	5.15
20OCT1995	188.02	6.80	5.11
21OCT1995	188.14	6.80	5.11
22OCT1995	188.14	6.80	5.11
23OCT1995	188.24	6.80	5.12
24OCT1995	188.44	6.80	5.21
25OCT1995	188.43	6.80	5.27
26OCT1995	188.41	6.80	5.29
27OCT1995	188.37	6.80	5.30
28OCT1995	188.39	6.80	5.29
29OCT1995	188.39	6.80	5.29
30OCT1995	188.57	6.80	5.32
31OCT1995	188.11	6.80	5.30
01NOV1995	186.79	6.80	3.37
02NOV1995	185.93	6.80	3.35
03NOV1995	185.59	6.80	3.40
04NOV1995	185.40	6.80	3.40
05NOV1995	185.30	6.80	3.37
06NOV1995	185.25	6.80	3.35
07NOV1995	185.22	6.80	3.34
08NOV1995	185.61	6.80	3.71
09NOV1995	185.46	6.80	3.41
10NOV1995	185.34	6.80	3.38
11NOV1995	185.32	6.80	3.37
12NOV1995	185.27	6.80	3.34
13NOV1995	185.20	6.80	3.31
14NOV1995	M	M	3.31
15NOV1995	M	M	3.38
16NOV1995	M	M	3.37
17NOV1995	M	M	3.35
18NOV1995	M	M	3.35
19NOV1995	M	M	3.35
20NOV1995	M	M	3.35
21NOV1995	M	M	3.35
22NOV1995	M	M	3.35
23NOV1995	M	M	3.37
24NOV1995	M	M	3.37
25NOV1995	M	M	3.35
26NOV1995	M	M	3.35
27NOV1995	M	M	3.37
28NOV1995	M	M	3.38
29NOV1995	M	M	3.37
30NOV1995	M	M	3.38



TRACT NO.	LAND OWNER	ACREAGE FEE	ACREAGE EASM'T			REMARKS
100	MKM, A General Partnership	11.72				
101-1	CRANE, BERT ANDREW, et al	73.89				
101-3	" " " "	3.00				
101E-1	" " " "		999.10			Occasional Flowage Easement
101E-2	" " " "		58.40			Occasional Flowage Easement
101E-3	" " " "		7.77			Temp. Construction Easement
101E-4	" " " "		80.30			Temp. Construction Easement
101E-5	" " " "		31.3			Temp. Construction Easement
105	ELLIS, BURTON F. et ux		0.73			Occasional Flowage Easement
105E	" " " "		103.6			Occasional Flowage Easement
106E	ROHRER, TRUDY A.		4.5			Occasional Flowage Easement
107	LANCE, WILLIAM C.	12.0				
108E	FISHER, GORDON H. et ux		22.05			Occasional Flowage Easement
108E-1	FISHER, GORDON H.		6.75			Permanent Flowage Easement
109-E	HUNES, EDWARD & KATIE TR.		16.9			Occasional Flowage Easement
110E	BAKER, JOE et ux		8.9			Occasional Flowage Easement
112E	SOUZA, STANLEY M., et ux		23.70			Occasional Flowage Easement
114E	THORNHILL, WILDA MOZELI		4.2			Occasional Flowage Easement
116E	DENOUDEN, CASE&JOHANNA		6.00			Occasional Flowage Easement
116E-1	CRANE, BERT S.		29.83			Occasional Flowage Easement
119E	DENOUDEN, CASE&JOHANNA		41.00			Occasional Flowage Easement
120E	CEDERLUND, DENNIS, ET UX		43.70			Occasional Flowage Easement
121E	THOMASON, MARION C.		60.38			Occasional Flowage Easement
122E	KUYKENDALL, LEWIS		18.37			Occasional Flowage Easement
123E	FLORES, ARNALDO, et ux		10.42			Occasional Flowage Easement
124E	SILVA, FRANK, et ux		8.3			Occasional Flowage Easement



Temp. Construction Easement

LOCAL COOPERATIVE AGREEMENT

PROJECT MAP

DEPT. OF THE ARMY
U.S. ARMY CORPS
USING SERVICE OF ENGINEERS

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY MERCED
DIVISION SOUTH PACIFIC
DISTRICT SACRAMENTO
ARMY AREA 8TH
8 MILES North OF Merced
4 MILES East OF Wilton

TRANSPORTATION FACILITIES

RAILROADS N/A
STATE ROADS 59
FEDERAL ROADS N/A
AIR LINES N/A

ACQUISITION

TOTAL ACRES ACQUIRED
FEE
PUBLIC DOMAIN: WITHDRAWAL / USE PERMIT
USE PERMIT (OTHER THAN P. D.)
TRANSFER
LEASE
LESSER INTERESTS

DISPOSAL

TOTAL ACRES DISPOSED OF
SOLD
PUBLIC DOMAIN: WITHDRAWAL / USE PERMIT
USE PERMIT (OTHER THAN P. D.)
TRANSFERRED
LEASES TERMINATED
LESSER INTERESTS TERM.
REASSIGNED
OTHER

LEGEND

EXCEPT FOR THE SPECIAL SYMBOLS SHOWN BELOW MAP SYMBOLS ARE STANDARD IN DEPERSE MAPPING AGENCY TECHNICAL MANUAL NO. 23.

RESERVATION LINE
RESERVATION LINE (Aerial Survey)
TRACT BOUNDARY LINE
TRACT NUMBER
CONTOUR LINE Max. Flowage
DISPOSAL
EXTENDED OWNERSHIP LINE

DATE	REVISIONS	BY
31 Mar 86	Added Tracts 108E-1 & 116E-1	BVT
7 Dec 89	Added Tracts for Phase 2	KLA
23 May 89	Deleted Tr 100E, Added Tr 100E-2	KLA
5 Dec 88	New Segment Map - LCA Project	KLA

DRAWN BY KLA
TRACED BY
CHECKED BY KLA
SUBMITTED BY:
RECOMMENDED BY:
APPROVED BY:
DATE

REAL ESTATE

CASTLE DAM

MERCED COUNTY STREAMS

US ARMY CORPS OF ENGINEERS, WASH DC 20314

INSTALLATION OR PROJECT NO.

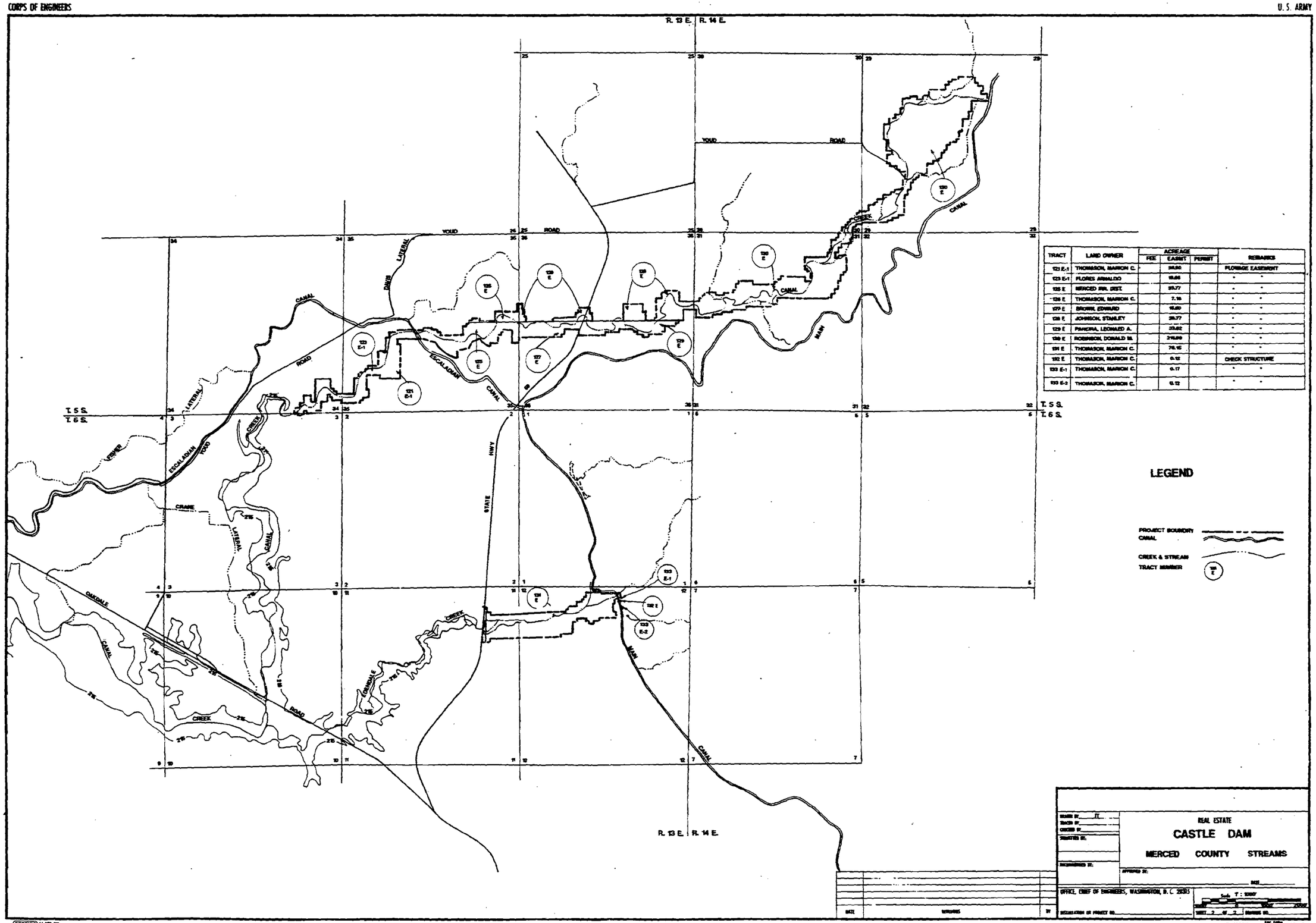
Scale 1" : 1000'

SHEET 1 OF 1 DRAWING NO.

(ER 405-1-12) APPENDIX A-1 ERG FORM 1486-A, Oct 87

SUPERSEDES OF OCT 85 WILL BE USED.

156

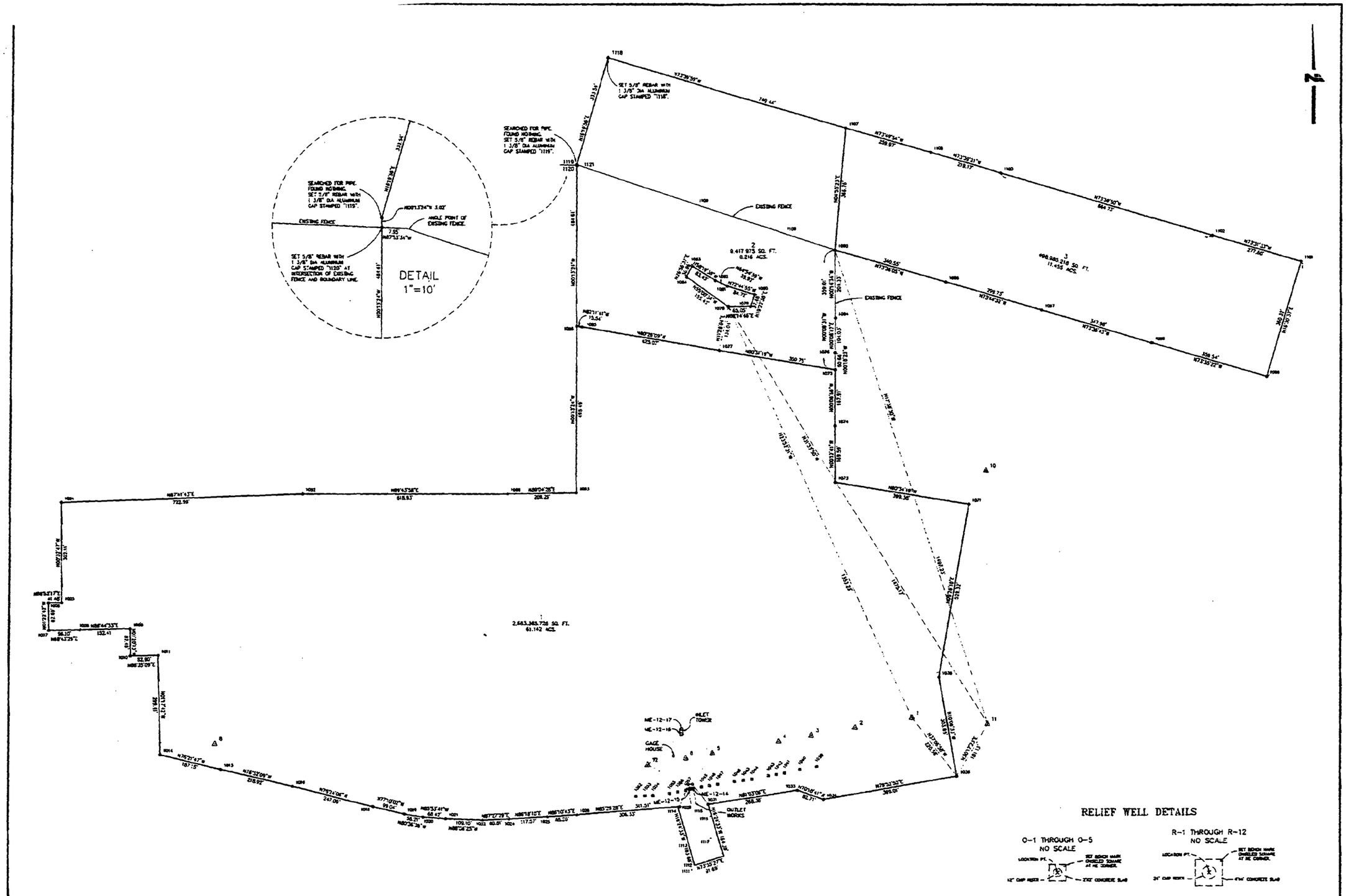


TRACT	LAND OWNER	ACREAGE FEE	ACREAGE EASMT	ACREAGE PERMIT	REMARKS
123 E-1	THOMASON, MARION C.		38.80		FLOWAGE EASEMENT
123 E-1	FLORES ARNALDO		18.86		" "
125 E	MERCED IRR. DIST.		33.77		" "
126 E	THOMASON, MARION C.		7.18		" "
127 E	BROWN, EDWARD		16.60		" "
128 E	JOHNSON, STANLEY		28.77		" "
129 E	PAREIRA, LEONARD A.		33.62		" "
130 E	ROBINSON, DONALD M.		210.69		" "
131 E	THOMASON, MARION C.		76.15		" "
132 E	THOMASON, MARION C.		0.12		CHECK STRUCTURE
133 E-1	THOMASON, MARION C.		0.17		" "
133 E-2	THOMASON, MARION C.		0.12		" "

REAL ESTATE
CASTLE DAM
MERCED COUNTY STREAMS

OFFICE, CHIEF OF ENGINEERS, WASHINGTON, D.C. 20315

APPENDIX A-2



DATE:	04-06-93
SCALE:	1"=100'
DRAWN BY:	B.E.B.
CHECKED BY:	B.E.B.
PROJ. MGR.:	B.E.B.
PROJ. ENGR.:	B.E.B.

NO.	BY	DATE	REVISIONS
1			
2			
3			
4			
5	BEB	04/06/93	ADDED MONUMENTS 1114, 1116, AND 1120 AS SET 04/04/93

NOLTE and ASSOCIATES
Engineers / Planners / Surveyors
Sacramento (916) 441-1520 · San Diego (619) 279-1392 · San Jose (408) 297-3400 · Walnut Creek (415) 934-4080

ARMY CORPS OF ENGINEERS
CASTLE DAM SURVEY
MERCED COUNTY CALIFORNIA

SHEET 1 OF 1 SHEETS
JOB NO. 2148-94-07

N:\S2148094\07\DRAW11\CASTLEC.DWG

LEGAL DESCRIPTION
OF FENCE ENCLOSURES
AT CASTLE DAM

ALL THAT CERTAIN REAL PROPERTY SITUATE IN THE COUNTY OF MERCED, STATE OF CALIFORNIA BEING A PORTION OF SECTIONS 15, 16, 21, AND 22, T.6 S., R.13 E., MOUNT DIABLO MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

PARCEL I:

BEGINNING AT THE SOUTHEAST FENCE CORNER OF A BARBED-WIRE FENCE ENCLOSURE FROM WHICH A BRASS DISC DESCRIBED AS B.M.1 ON SHEET S-2 OF THE PLANS PREPARED BY THE ARMY CORPS OF ENGINEERS ENTITLED "CASTLE DAM AND RESERVOIR, FILE NO. ME-12-4-19" BEARS NORTH 37°06'58" WEST 220.58 FEET, SAID POINT ALSO BEING SOUTH 30°17'23" WEST 181.13 FEET FROM REFERENCE MONUMENT "A" AS SAID MONUMENT IS SHOWN ON THE RECORD OF SURVEY FOR U.S.A., FILED IN BOOK 20 OF SURVEYS, AT PAGES 13 THROUGH 20, MERCED COUNTY RECORDS: THENCE FROM SAID POINT OF BEGINNING ALONG SAID BARBED-WIRE FENCE LINE THE FOLLOWING THIRTY-SEVEN (37) COURSES: 1) SOUTH 79°52'50" WEST 399.01 FEET; 2) NORTH 70°10'41" WEST 82.71 FEET; 3) SOUTH 81°03'06" WEST 268.38 FEET; 4) SOUTH 16°24'33" EAST 164.39 FEET; 5) SOUTH 73°35'27" WEST 91.69 FEET; 6) NORTH 16°24'33" WEST 183.88 FEET; 7) SOUTH 85°29'28" WEST 311.51 FEET; 8) SOUTH 86°10'43" WEST 88.20 FEET; 9) SOUTH 86°18'10" WEST 117.57 FEET; 10) SOUTH 87°27'29" WEST 80.81 FEET; 11) NORTH 88°06'25" WEST 109.10 FEET; 12) NORTH 85°53'41" WEST 68.42 FEET; 13) NORTH 80°36'26" WEST 58.21 FEET; 14) NORTH 77°10'02" WEST 99.04 FEET; 15) NORTH 76°24'06" WEST 247.09 FEET; 16) NORTH 76°32'09" WEST 218.92 FEET; 17) NORTH 76°21'47" WEST 187.15 FEET; 18) NORTH 01°17'42" WEST 299.41 FEET; 19) SOUTH 88°35'09" WEST 82.90 FEET; 20) NORTH 01°20'13" WEST 82.46 FEET; 21) SOUTH 88°44'33" WEST 152.41 FEET; 22) SOUTH 88°43'29" WEST 96.10 FEET; 23) NORTH 01°22'42" WEST 82.69 FEET; 24) NORTH 88°52'17" EAST 41.48 FEET; 25) NORTH 00°32'47" WEST 302.11 FEET; 26) NORTH 87°41'43" EAST 722.59 FEET; 27) NORTH 89°43'58" EAST 618.93 FEET; 28) NORTH 89°04'28" EAST 209.29 FEET; 29) NORTH 00°13'24" WEST 498.49 FEET; 30) SOUTH 82°11'41" EAST 15.54 FEET; 31) SOUTH 80°26'09" EAST 425.07 FEET TO A POINT HEREINAFTER CALLED POINT "X" 32) SOUTH 80°31'19" EAST 350.73 FEET TO A POINT HEREINAFTER CALLED POINT "Y" 33) SOUTH 00°06'56" EAST 167.91 FEET; 34) SOUTH 00°12'41" EAST 169.59 FEET; 35) SOUTH 80°34'19" EAST 399.38 FEET; 36) SOUTH 09°26'10" WEST 529.32 FEET; AND 37) SOUTH 10°06'33" EAST 303.85 FEET TO THE POINT OF BEGINNING AND CONTAINING 60.902 ACRES, MORE OR LESS. EXCEPTING THEREFROM, THAT CERTAIN PARCEL OF LAND LYING SOUTHERLY OF THE NORTHERLY BOUNDARY LINE OF SECTIONS 21 AND 22 T.6 S., R.13 E., MOUNT DIABLO MERIDIAN CONTAINING 12.290 ACRES, MORE OR LESS.

PARCEL II:

BEGINNING AT THE ANGLE POINT IN THE BARBED WIRE FENCE ENCLOSURE DESCRIBED AS POINT "Y" IN THE AFOREMENTIONED PARCEL I AND RUNNING

THENCE FROM SAID POINT "Y" THE FOLLOWING EIGHTEEN (18) COURSES: 1) NORTH 00°18'23" WEST 50.66 FEET; 2) NORTH 00°08'12" WEST 104.03 FEET; 3) NORTH 00°14'34" WEST 204.33 FEET; 4) SOUTH 73°36'05" EAST 340.55 FEET; 5) SOUTH 73°44'32" EAST 299.73 FEET; 6) SOUTH 73°36'43" EAST 347.98 FEET; 7) SOUTH 73°35'22" EAST 359.54 FEET; 8) NORTH 16°30'37" EAST 360.32 FEET; 9) NORTH 73°31'33" WEST 277.60 FEET; 10) NORTH 73°39'50" WEST 664.73 FEET; 11) NORTH 73°39'21" WEST 219.17 FEET; 12) NORTH 73°49'54" WEST 259.97 FEET; 13) NORTH 73°39'59" WEST 749.44 FEET; 14) SOUTH 16°19'56" WEST 333.54 FEET; 15) SOUTH 00°13'24" EAST 484.61 FEET; 16) SOUTH 82°11'41" EAST 15.54 FEET; 17) SOUTH 80°26'09" EAST 425.07 FEET TO A POINT CALLED POINT "X" IN THE AFOREMENTIONED PARCEL I AND 18) SOUTH 80°31'19" EAST 350.73 FEET TO THE POINT OF BEGINNING AND CONTAINING 25.239 ACRES MORE OR LESS.

MERCED COUNTY STREAMS, CALIFORNIA

CASTLE DAM AND RESERVOIR

FILE NO. ME-12-4-19

SCHEDULE OF DRAWINGS

SEQ. NO.	SHT. NO.	TITLE OF DRAWING	SEQ. NO.	SHT. NO.	TITLE OF DRAWING
		GENERAL			△ GEOTECHNICAL
1	G-1	COVER SHEET - INDEX AND ABBREVIATIONS			FOUNDATION EXPLORATION
2	G-2	PROJECT LOCATION, SITE PLAN, LOCATION AND VICINITY MAPS	26	CG-1	AERIAL GEOLOGY AND EXPLORATIONS
3	G-3	RESERVOIR MAP	27	CG-2	GEOLOGIC SEISMIC SECTIONS
4	G-4	BORROW AREAS	28	CG-3	LOGS OF FOUNDATION DRILL HOLES 2F-1 THRU 2F-3
			29	CG-4	LOGS OF FOUNDATION DRILL HOLES 2F-4 THRU 2F-6
			30	CG-5	LOGS OF FOUNDATION DRILL HOLES 2F-7 THRU 2F-9
		STRUCTURE	31	CG-6	LOGS OF BORINGS 2F-10 AND 2F-11
5	S-1	MAIN DAM, SPILLWAY AND DIKE PLAN, SECTION, AND DETAILS	32	CG-7	LOGS OF BORINGS 2F-12 AND 2F-13
6	S-2	MAIN DAM AND DIKE "B" - PLAN, PROFILE AND SECTION	33	CG-8	LOGS OF BORINGS 2F-14 AND 2F-15
7	S-3	IMPERVIOUS BLANKET AREA - CROSS-SECTIONS	34	CG-9	LOGS OF BORINGS 2F-16 THRU 2F-19
8	S-4	REQUIRED BORROW AREA - CROSS SECTIONS	35	CG-10	LOGS OF FOUNDATION DRILL HOLES 7F-1 AND 7F-2
8A	S-4A	MISCELLANEOUS DAM CROSS-SECTIONS	36	CG-11	LOGS OF TRENCHES 4F-1 THRU 4F-9
9	S-5	DIKE A PLAN, PROFILE AND SECTION	37	CG-12	LOGS OF TRENCHES 4F-10 THRU 4F-17
			38	CG-13	LOGS OF TRENCHES 4F-18 THRU 4F-23
			39	CG-14	LOGS OF TRENCHES 4G-1 THRU 4G-4
		SPILLWAY	40	CG-15	LOGS OF TRENCHES SPILLWAY AREA 4B-1 THRU 4B-5 & 4B-13
10	S-6	SPILLWAY PLAN, PROFILE, DETAIL, AND SECTIONS	41	CG-16	GEOLOGIC SECTION A-A' ON DAM AXIS
11	S-7	SPILLWAY STRUCTURAL DIMENSIONS AND REINFORCEMENT	42	CG-17	GEOLOGIC SECTIONS MAIN DAM B-B' THRU G-G'
			43	CG-18	GEOLOGIC SECTIONS H-H' DIKE B AND I-I' DIKE A
			44	CG-19	SPILLWAY GEOLOGIC SECTIONS S1-S1' AND S2-S2'
		OUTLET WORKS			
12	S-8	OUTLET WORKS - GENERAL PLAN, PROFILE, AND SECTIONS			
13	S-9	OUTLET WORKS INTAKE STRUCTURE PLAN, DETAILS, AND SECTIONS			BORROW AREA EXPLORATIONS
14	S-10	OUTLET WORKS INTAKE STRUCT. REINF. PLAN, DETAILS, AND SECT.	45	CG-20	LOGS OF TRENCHES-REQUIRED BORROW AREA 4B-6 THRU 4B-12, 4B-14
15	S-11	OUTLET WORKS CONDUIT PROFILE, DETAILS, AND SECTIONS	46	CG-21	LOGS OF TRENCHES-REQUIRED BORROW AREA 4B-15 THRU 4B-21
16	S-12	O. W. STILLING BASIN STRUCT. DIM. AND REINFORCEMENT			
17	S-13	OUTLET WORKS MISCELLANEOUS METAL DETAILS			
					TOPOGRAPHY SHEETS
			47	T-1	△ SITE TOPOGRAPHY INDEX SHEET
		MECHANICAL	48	T-2	△ SITE TOPOGRAPHY SHEET 2
18	M-1	MECHANICAL GATE DETAIL AND STAFF GAGE	49	T-3	△ SITE TOPOGRAPHY SHEET 3
			50	T-4	△ SITE TOPOGRAPHY SHEET 4
			51	T-5	△ SITE TOPOGRAPHY SHEET 6
		MISCELLANEOUS	52	T-6	△ SITE TOPOGRAPHY SHEET 9
19	H-1	HYDROLOGIC AND COMMUNICATION FACILITY	53	T-7	△ SITE TOPOGRAPHY SHEET 10
			54	T-8	△ SURVEY COORDINATE SHEET
			55	T-9	△ SURVEY COORDINATE INDEX SHEET
		△ ACCESS ROAD			
20	R-1	ACCESS ROAD PLAN, INTERSECTIONS AND SECTIONS			
21	R-2	△ ACCESS ROAD PLAN & PROFILE - STA. 0+00 TO STA. 17+00			△ ~~MAIN CANAL CHECK STRUCTURE~~ ELIMINATED
21A	R-3	△ ACCESS ROAD PLAN & PROFILE - STA. 17+00 TO STA. 34+00	~~56~~	~~C-1~~	△ ~~GENERAL INFORMATION SHEET~~ ELIMINATED
22	R-4	△ ACCESS ROAD PLAN & PROFILE - STA. 34+00 TO STA. 51+00	~~57~~	~~C-1~~	△ ~~SITE PLAN~~ ELIMINATED
22A	R-5	△ ACCESS ROAD PLAN & PROFILE - STA. 51+00 TO STA. 66+00	~~58~~	~~C-2~~	△ ~~LOG OF DRILL HOLES~~ ELIMINATED
23	R-6	△ ACCESS ROAD PLAN & PROFILE - STA. 66+00 TO STA. 80+00	~~59~~	~~S-1~~	△ ~~EXCAVATION PLAN, PROFILE & SECTION~~ ELIMINATED
24	R-7	△ ACCESS ROAD PLAN & PROFILE - STA. 80+00 TO STA. 88+31.66	~~60~~	~~S-1~~	△ ~~FOUNDATION PLAN AND DETAILS~~ ELIMINATED
25	R-8	△ PROPERTY FENCE, FENCE AND GATE DETAILS	~~61~~	~~S-2~~	△ ~~FOOTING PLAN AND DETAILS~~ ELIMINATED
			~~62~~	~~S-3~~	△ ~~TRUSS PLAN AND DETAILS~~ ELIMINATED
			~~63~~	~~S-4~~	△ ~~KAMPING CREEK GATE STRUCTURE~~ ELIMINATED

ABBREVIATIONS

ACC.	ACCESS
A.C.I.	AMERICAN CONCRETE INSTITUTE
ALM. P	ALUMINUM PIPE
ALT.	ALTERNATE
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
AVE.	AVENUE
AVG.	AVERAGE
&	AND
<	ANGLE
B.M.	BENCH MARK
B.F.	BOTTOM FACE
C	CONSTRUCTION
C.C.	CENTER-TO-CENTER
C.J.	CONSTRUCTION JOINT
℄	CENTERLINE
CLR.	CLEAR
C.M.P.	CORRUGATED METAL PIPE
CONC.	CONCRETE
CONTR. JT.	CONTRACTION JOINT
CP	CHECK POINT
CR.	CASTLE RESERVOIR
C.Y.	CUBIC YARD
D, DIA.	DIAMETER
DEF. <	DEFLECTION ANGLE
D/S	DOWNSTREAM
ø	PHI OR ROUND
E	EAST OR EACH
E.F.	EACH FACE
EL., ELEV.	ELEVATION
EXPAN.	EXPANSION
F.	FACE
F.B.	FLAT BAR
f'c	CONCRETE COMPRESSIVE STRENGTH
FL	FLOOR
FT.	FOOT OR FEET
fy	REINFORCING STEEL YIELD STRENGTH
GA.	GAGE
GALV.	GALVANIZED
GOV'T	GOVERNMENT
H	HEIGHT
HORIZ.	HORIZONTAL
INV.	INVERT
J, JT.	JOINT
L	LENGTH OF CURVE
L.F.	LINEAR FEET
MAX.	MAXIMUM
MIN.	MINIMUM
MM	MILLIMETER
N	NORTH
NO.	NUMBER
O.D.	OUTSIDE DIAMETER
P.C.	POINT OF CURVATURE
P.I.	POINT OF INTERSECTION
PL	PLATE
PSI	POUNDS PER SQUARE INCH
P.T.	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
R	RADIUS
RD.	ROAD
REINF.	REINFORCING
REQ.	REQUIRED
S	SOUTH OR SLOPE
SECT.	SECTION
SHT.	SHEET
SQ.	SQUARE
STA.	STATION
STAB.	STABILIZED
T	TANGENT
T.S.	STRUCTURAL TUBING
TYP.	TYPICAL
U/S	UPSTREAM
V	VERTICAL
V.C.	VERTICAL CURVE
W	WAY
W/	WITH

NOTES:

1. GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.
2. ALL ELEVATIONS REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. SYMBOLS FOR CONCRETE STRUCTURES IN ACCORDANCE WITH ACI 315.
4. WELD SYMBOLS IN ACCORDANCE WITH AWS A 2.4-79.

AS-CONSTRUCTED
CONTR. NO. 91-C-0055

REVISION	DATE	DESCRIPTION	BY	BY
△	15 Jan 91	DELETE SHEETS	RM	
△	26 OCT 90	ADD NEW DRAWINGS	GC	
△	13 JULY 88	DELETED DWGS. ADD NEW DWG.	GC	
△	24 MAY 89	DELETE DWGS. ADD NEW DWG.	GC	

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: L. RENNING
DRAWN: E. CLAWSON
CHECKED: D. HORTON
SUBMITTED: Donald Horton, CHIEF, CIVIL DESIGN BRANCH

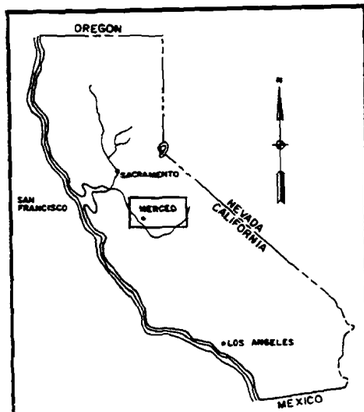
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
COVER SHEET
INDEX AND ABBREVIATIONS

SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDEXED ON THIS SHEET

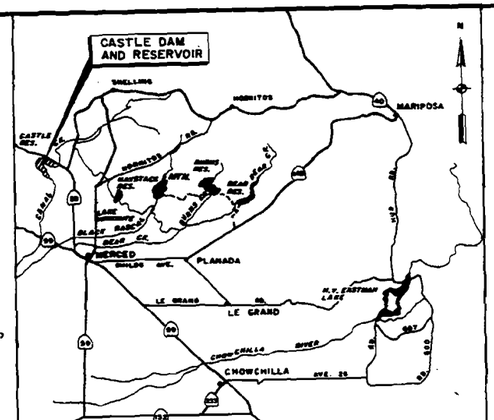
APPROVED: Thomas E. Nash, CHIEF, DESIGN BRANCH — DATE: 3 MAY 1989
DRAWN UNDER THE DIRECTION OF: JACK A. Le CUYER, CHIEF, DESIGN BRANCH
SCALE: NONE — DWG. No. 6332A
SHEET G-1 1 — FILE No. ME-12-4-19

PLATE 1

AM-2



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

LEGEND:

- UNPAVED ROAD
- HIGHWAYS, STATE
- PAVED ROAD
- INTERMITTENT STREAM
- PROPOSED ACCESS ROAD (UNPAVED)

N

BENCH MARKS

STATION	EASTING	NORTHING	ELEVATION GROUND	ELEVATION PIS	DESCRIPTION
CR1	1,978,280.707	339,739.302	217.84	218.06	ME 12-1 Std USCE Br Cap set in conc
CR2	1,982,230.705	341,812.027	225.93	226.88	ME 12-2 Std USCE Br Cap set in conc
CR3	1,986,189.111	342,804.040	233.23	233.23	5/8" Iron Pin
CR4-A	1,989,1[illegible]	343,215.072	233.29	233.29	5/8" Iron Pin
CR4	1,990,889.063	345,052.087	235.42	235.42	5/8" Iron Pin
CR5	1,994,690.022	347,787.173	246.15	246.13	ME 12-3 Std USCE Br Cap set in conc
CR6	1,997,357.925	342,311.355	258.56	258.56	ME 12-4 Std USCE Br Cap set in conc
CR7	1,995,739.376	340,886.308	245.04	245.06	ME 12-5 Std USCE Br Cap set in conc
CR7-A	1,995,051.581	344,837.108	266.45	266.45	5/8" Iron Pin
CR8	1,988,179.773	338,720.308	216.98	216.98	5/8" Iron Pin
CR9	1,984,729.372	338,035.903	286.25	286.30	ME 12-6 Std USCE Br Cap set in conc
CR10	1,980,077.723	336,652.643	220.26	220.26	ME 12-7 Std USCE Br Cap set in conc
CR11	1,982,121.800	333,550.654	243.30	243.35	ME 12-8 Std USCE BR Cap set in conc
CR12	1,988,721.233	335,184.463	290.93	290.85	ME 12-9 Std USCE Br Cap set in conc
CR12-A	1,990,939.735	334,757.134	285.11	285.08	5/8" Iron Pin
CR12-B	1,986,985.076	333,459.129	263.63	263.58	5/8" Iron Pin
CR13	1,992,375.608	336,428.276	210.29	210.29	5/8" Iron Pin
CR14	1,998,445.344	340,991.715	233.24	233.24	5/8" Iron Pin
CR15	1,996,606.816	335,512.992	238.04	238.04	USC & GS Br Cap BMX-236
CR16	1,982,884.529	333,283.987	272.02	272.00	5/8" Iron Pin
CR17	1,989,730.127	330,681.234	222.36	222.42	ME 12-11 Std USCE Br Cap set in conc
CR18	1,987,716.711	330,491.560	221.21	221.21	5/8" Iron Pin
CR19	1,987,242.006	328,634.984	213.08	213.08	ME 12-10 Std USCE Br Cap set in conc
CR20	1,989,316.984	330,058.123	222.88	222.87	5/8" Iron Pin
CR21	1,990,159.511	326,609.679	186.11	186.11	5/8" Iron Pin
CR22	1,988,353.920	326,693.125	197.30	197.30	5/8" Iron Pin
CR23	1,986,577.035	326,627.916	197.06	197.06	5/8" Iron Pin
CR24	1,985,394.107	326,625.593	200.93	200.93	5/8" Iron Pin
CR25	1,985,928.524	330,810.208	211.03	211.03	5/8" Iron Pin
CR30	1,991,034.332	326,552.757	195.35	195.35	5/8" Iron Pin
CR31	1,991,001.507	329,076.646	220.76	220.76	ME 12-12 Std USCE Br Cap set in conc
CR [illegible]	1,991,0[illegible]5.3[illegible]	[illegible]04.88	233.[illegible]	233.27	[illegible]

NOTES

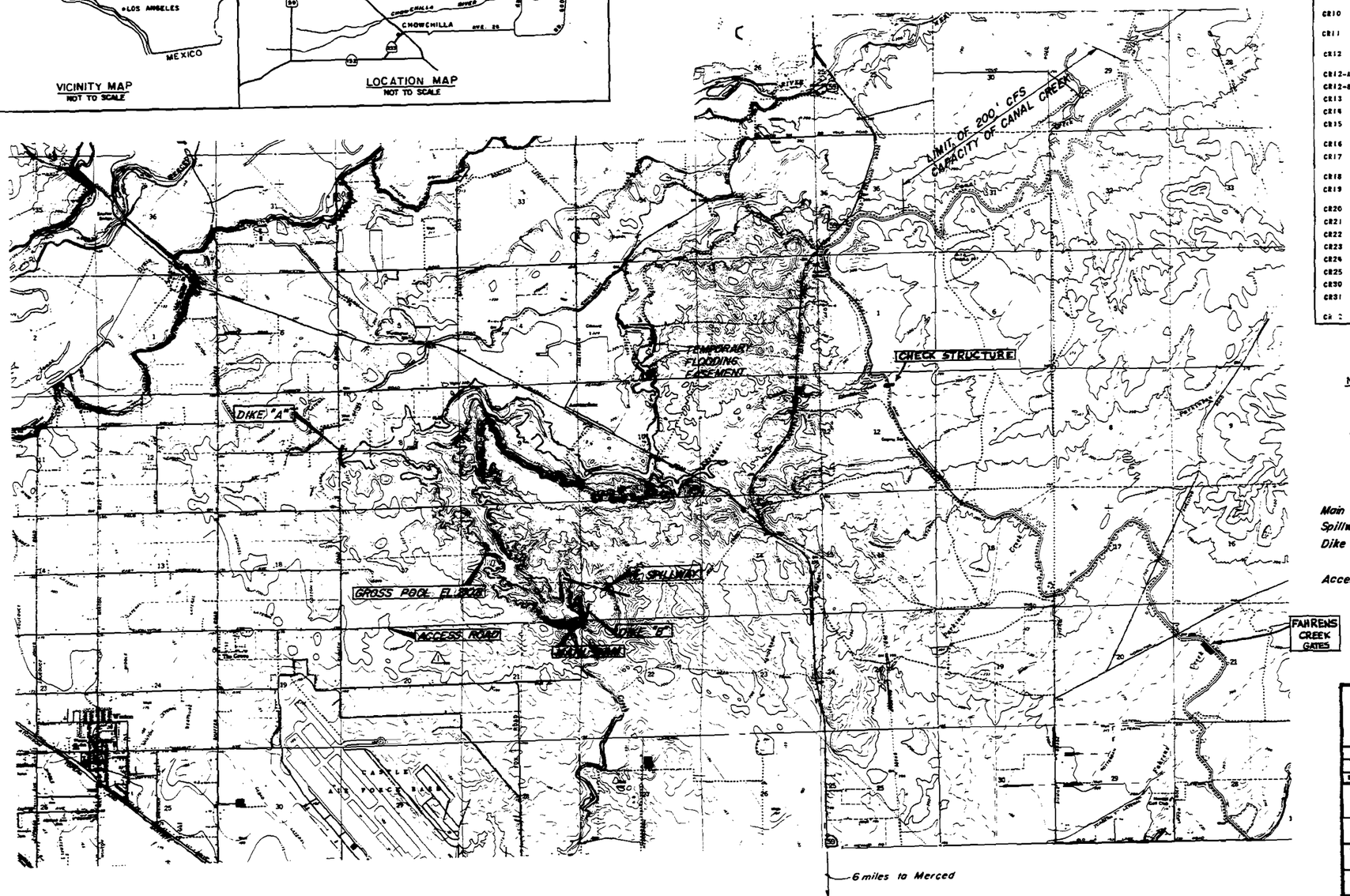
1. Site Plan composed of Winton and Yosemite Lake quadrangle sheets.
2. Contour interval 5 feet.
3. When requesting information on brass caps, use ME-12- designation.

REFERENCE DRAWINGS

Title	Sht. No.
Main Dam & Dike "B"	S-1 & S-2
Spillway	S-1 & S-6
Dike "A"	S-5
Access Road	R-1

GRAPHIC SCALE

1"=2000' 0 2000' 4000' 6000' 8000' 10000'



SITE PLAN
SCALE: 1"=2000'

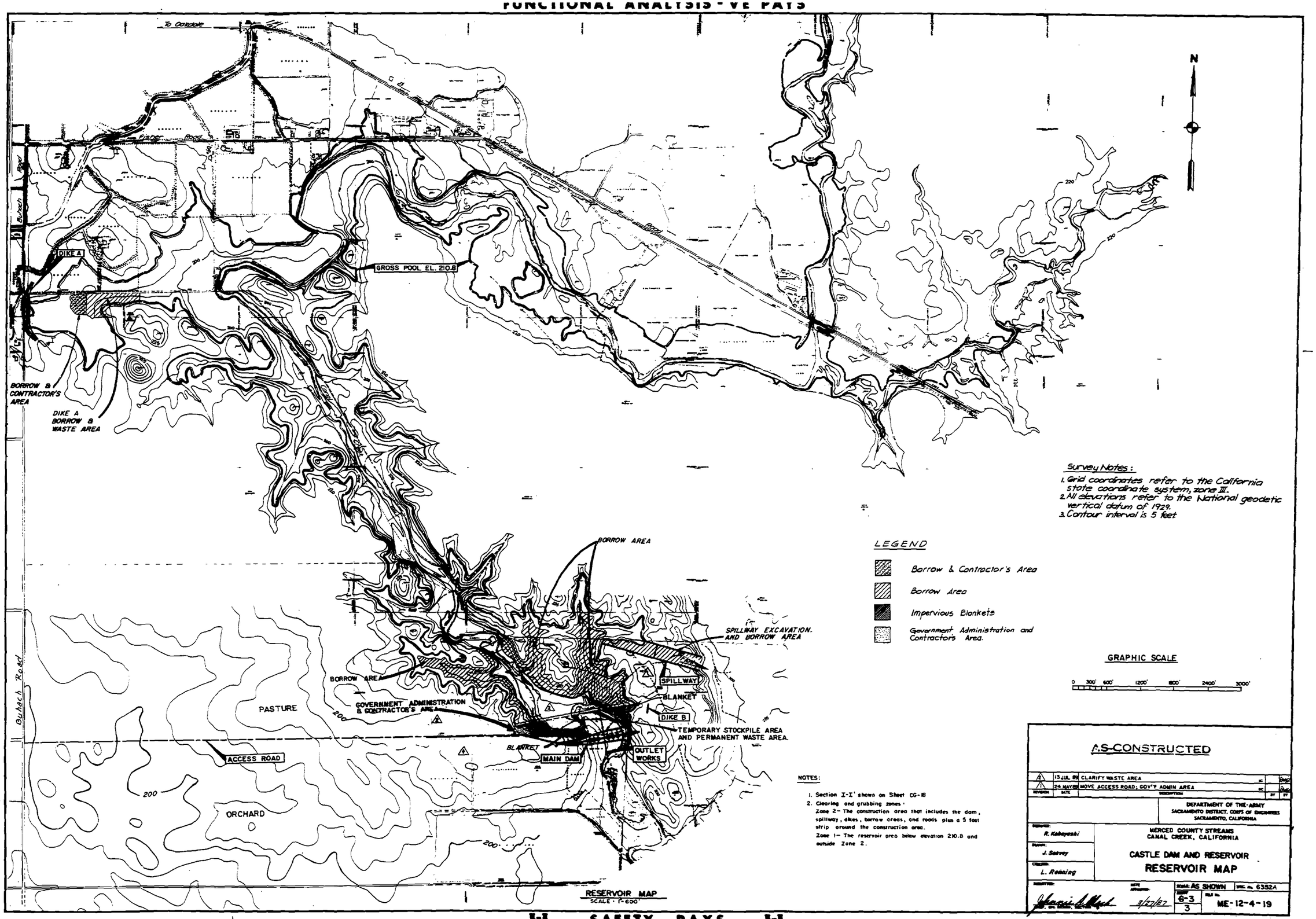
A	15 JAN 91	LOCATION OF CHECK STRUCTURE & TEMPORARY CANAL CENTER LINE	
1	24 MAY 85	SHOW CHANGE OF ACCESS ROAD	

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R. KOBAYASHI
DRAWN: L. SPRAGUE
TRACED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
PROJECT LOCATION
SITE PLAN, LOCATION, AND VICINITY MAPS

SCALE: AS SHOWN
FILE NO. 6332A
3/23/87
G-2
2
ME-12-4-19



Survey Notes:

1. Grid coordinates refer to the California state coordinate system, zone III.
2. All elevations refer to the National geodetic vertical datum of 1929.
3. Contour interval is 5 feet

NOTES:

1. Section I-I' shown on Sheet CG-18
2. Clearing and grubbing zones:
   Zone 2 - The construction area that includes the dam, spillway, dikes, borrow areas, and roads plus a 5 foot strip around the construction area.
   Zone 1 - The reservoir area below elevation 210.8 and outside Zone 2.

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	CHK'D
2	13 JUL 89	CLARIFY WASTE AREA	JC	
1	24 MAY 89	MOVE ACCESS ROAD; GOV'T ADMIN AREA	JC	

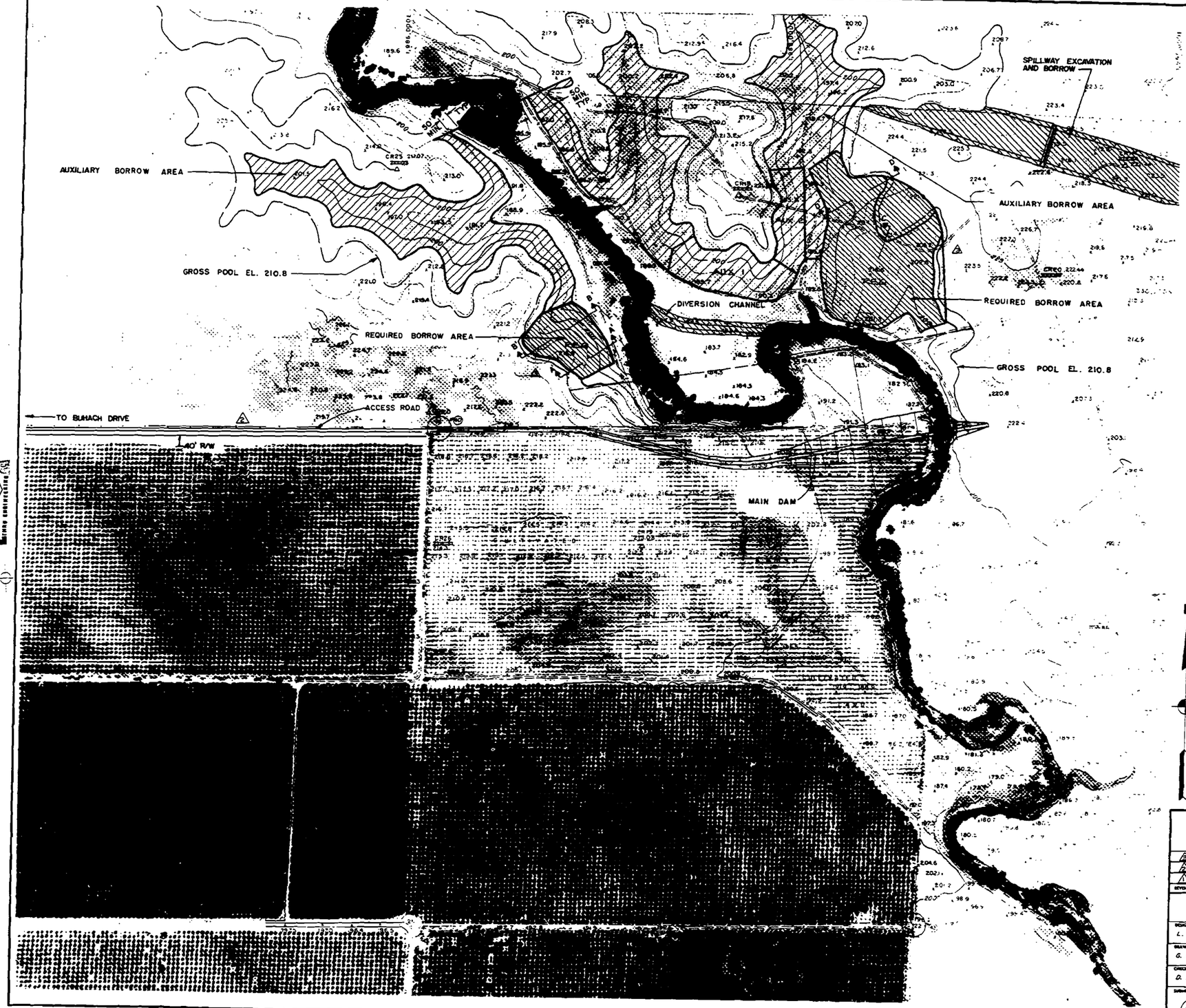
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R. Kobayashi
DRAWN: J. Sarvey
CHECKED: L. Renning

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA

CASTLE DAM AND RESERVOIR
RESERVOIR MAP

SUBMITTED: Francis A. Mack
DATE APPROVED: 3/27/87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET 6-3 3
FILE No. ME-12-4-19



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929

DATE OF AERIAL PHOTOGRAPHY:
USED FOR TOPOGRAPHIC MAP - 5-19-78

DATE OF AERIAL PHOTOGRAPHY:
USED FOR ORTHOPHOTO - 6-25-82

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-18-17

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

TOPOGRAPHIC MAP PREPARED BY EARTHDATA CORP - 1978

ORTHOPHOTO PREPARED BY [illegible] - 1982

NOTES:

1. GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.
   COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.
2. ORTHOTOPO FILE NO. ME-12-18-17
3. GROSS POOL LINE IS SHOWN IN APPROXIMATE POST CONSTRUCTION POSITION.
4. SEE SHEET S-4 FOR TYPICAL CROSS-SECTION IN REQUIRED BORROW AREA.

LEGEND

BORROW AREAS REQUIRING EXCAVATION TO SPECIFIED LINES AND GRADES.

AUXILIARY BORROW AREA

GRAPHIC SCALE

200 100 0 200 400 600 800

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION		
3	1 DEC 92	REVISED AS-CONSTRUCTED	DCM	
2	5 JUL 89	CLARIFY NEW ACCESS ROAD	EC	
1	24 MAY 83	SHOW ACCESS ROAD	EC	

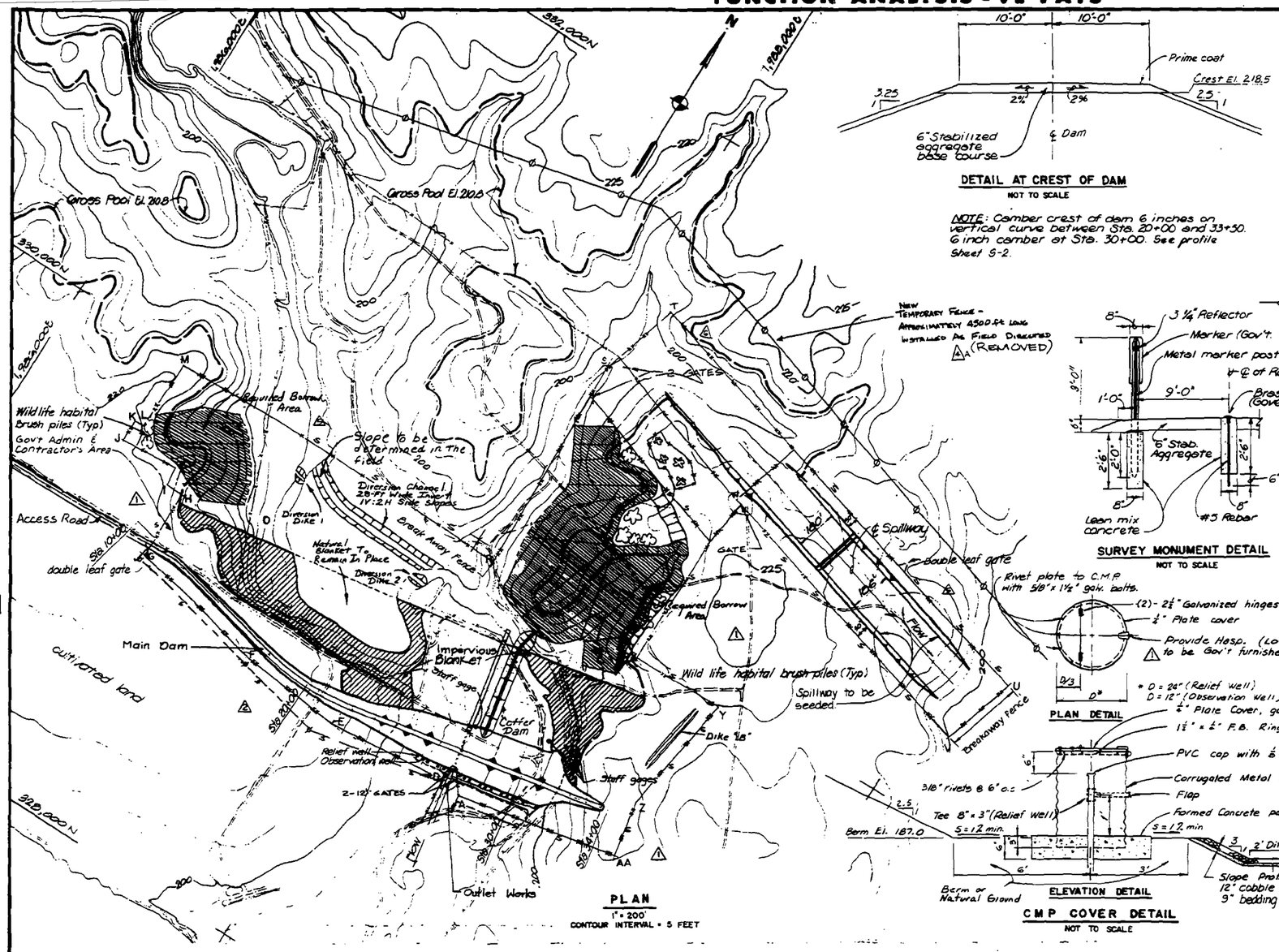
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: L. Renning
DRAWN: G. Bucknell
CHECKED: D. Ricketts

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
BORROW AREAS

SUBMITTED: Johnnie D. Mack, CHIEF, CIVIL DESIGN SECTION "B"
DATE APPROVED: 1/7/83

SCALE: 1" = 200'
SHEET: G-4
4
SPEC. No. 6352A
FILE No. ME-12-4-19



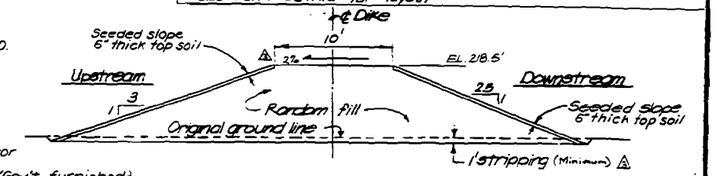
PLAN
1" = 200'
CONTOUR INTERVAL = 5 FEET

DETAIL AT CREST OF DAM
NOT TO SCALE

NOTE: Camber crest of dam 6 inches on vertical curve between Sta. 20+00 and 33+50. 6 inch camber at Sta. 30+00. See profile Sheet S-2.

RELIEF WELL AND OBERVATION WELL DATA								
WELL Nº	STATION	DEPTH, ft.	WELL Nº	STATION	DEPTH, ft.	WELL Nº	STATION	DEPTH, ft.
RW-1	25+50	40	RW-5	27+50	47	RW-9	29+50	47
OW-1	25+75	30	OW-3	27+75	37	OW-5	29+75	37
RW-2	26+00	40	RW-6	28+00	47	RW-10	30+00	47
RW-3	26+50	40	RW-7	28+50	47	RW-11	30+50	47
OW-2	26+75	30	OW-4	28+75	37	RW-12	31+00	47
RW-4	27+00	47	RW-8	29+00	47			

* See PLAN DETAIL for layout



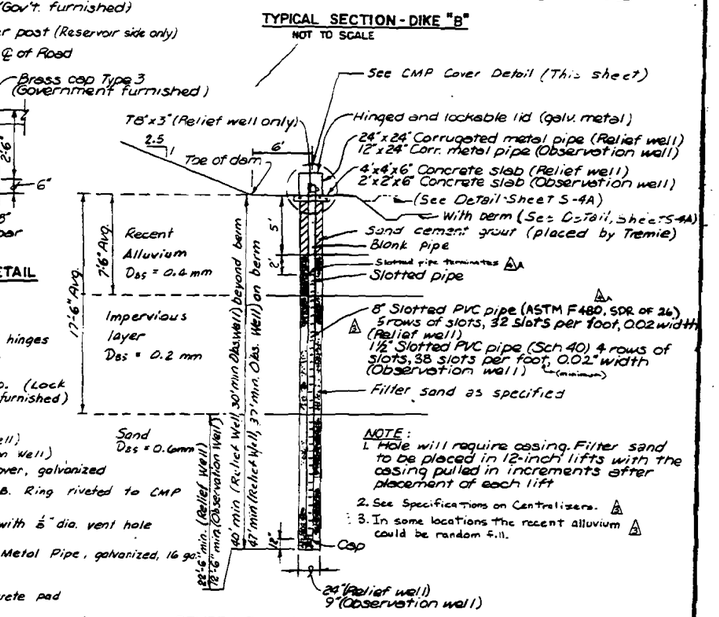
TYPICAL SECTION - DIKE "B"
NOT TO SCALE

SURVEY MONUMENT DETAIL
NOT TO SCALE

PLAN DETAIL

ELEVATION DETAIL

CMP COVER DETAIL
NOT TO SCALE



NOTE:
1. Hole will require casing. Filter sand to be placed in 12-inch lifts with the casing pulled in increments after placement of each lift
2. See Specifications on Centralizers.
3. In some locations the recent alluvium could be random fill.

RELIEF WELL AND OBSERVATION WELL
NOT TO SCALE

GRAPHIC SCALES:
1" = 200' 0 200' 400' 600' 800' 1000'
1" = 20' 0 10' 20' 40' 60' 80' 100'

FENCE CORNER COORDINATES

	NORTHING	EASTING		NORTHING	EASTING		NORTHING	EASTING
A	329,009.78	1,988,534.24	O	329,550.00	1,987,179.00	CP1	326,642.75	1,988,707.37
B	328,806.02	1,988,570.71	P	329,715.00	1,988,259.00		(E 1/4 CORNER SECTION 21, 1-1/4" O.D. IRON PIPE TAGGED L.S. 2457)	
C	328,779.59	1,988,423.06	Q	329,783.23	1,988,243.38	CP2	329,246.62	1,986,171.13
D	329,032.58	1,988,377.79	R	329,988.96	1,988,090.63		N 1/4 CORNER SECTION 21, 1-1/4" O.D. IRON PIPE TAGGED L.S. 2457)	
E	328,925.30	1,987,834.16	S	330,945.24	1,988,088.27	CP3	329,322.94	1,991,480.07
F	329,168.27	1,986,844.74	T	331,291.55	1,988,189.77		N 1/4 CORNER SECTION 22, 1-1/4" O.D. IRON PIPE TAGGED L.S. 2457)	
G	329,494.42	1,986,837.62	U	330,683.71	1,990,263.52			
H	329,492.61	1,986,754.73	V	330,338.24	1,990,162.27			
I	329,575.13	1,986,752.93	W	330,717.36	1,988,868.83			
J	329,569.71	1,986,504.29	X	330,020.89	1,988,870.56			
K	329,652.23	1,986,502.49	Y	329,955.21	1,989,264.67			
L	329,653.13	1,986,543.93	Z	329,433.11	1,989,177.66			
M	329,955.00	1,986,541.00						
N	329,972.00	1,986,962.00	AA	329,134.09	1,989,231.17			

LEGEND
—x— EXISTING FENCE
—N— NEW FENCE
—T— TEMP FENCE
S NO TRESPASSING, NO HUNTING

NOTES:
1. Grid coordinates refer to the California State Coordinate System, Zone III
2. All elevations refer to the National Geodetic Vertical Datum of 1929.
3. For survey monument table see sheet S-2
4. For Main Dam and Dike B alignment, fence and survey monument details see sheet S-2
5. For spillway alignment see sheet S-6.
6. See sheet S-4 for typical cross-sections in required borrow area.
7. Staff gages will be field located during construction.
8. For property fence and gate details see sheet R-8.
9. Tie new fencing into existing fence where applicable
10. Since Cattle are Present, New Fences are To be Installed Before Old Ones are Removed.

AS-CONSTRUCTED

4	10 MAR 94		
3	1 DEC 92	REVISED AS-CONSTRUCTED	DGE
2A	15 JAN 91	TEMPORARY FENCE AREA, NOTE OF FENCE, SLOTTED PIPE CHANGES	DGL
2	23 OCT 90	REVISION TO COMMENTS TO MATCH STAG. REV., 2% SLOPE ON DIKE	DGL
1	13 JUL 89	SHOW TEMP FENCE & WORK AREA LIMITS	
	24 MAY 89	ADD FENCE LEGEND, COORD. CHANGE GOV'T ADMIN. NOTES ETC.	
	DATE	DESCRIPTION	BY / CK

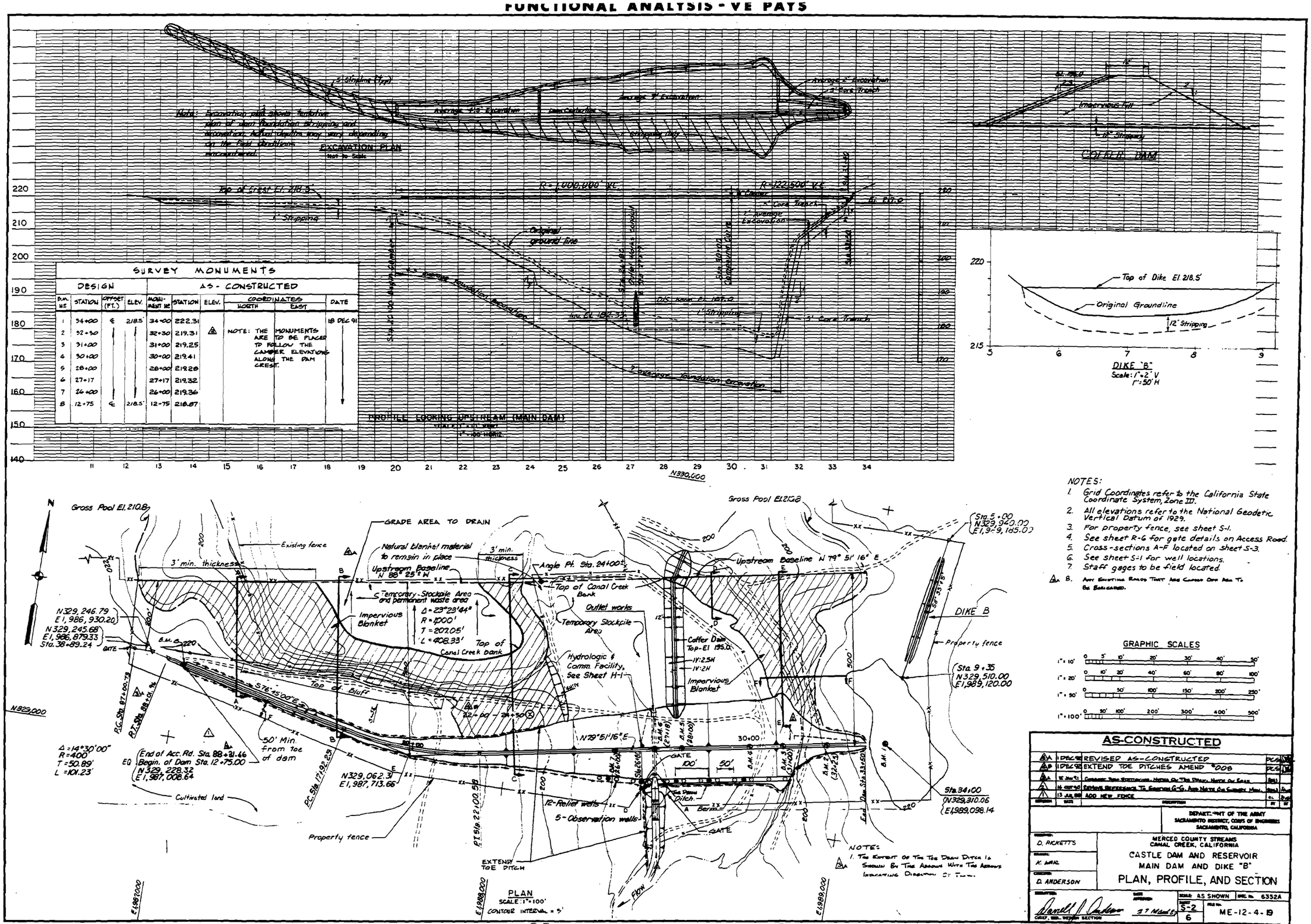
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

T. PEARSON
PL
D. ANDERSON

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
MAIN DAM, SPILLWAY, AND DIKE PLAN, SECTION, AND DETAILS

Chief, Eng. Design Section — 27 March 87 — S-1 — 3 — ME-12-4-19

AM-7



AS-CONSTRUCTED

1 DEC 92	REVISED AS-CONSTRUCTED		
17 DEC 92	EXTEND TOE PITCHES AMEND #008		
16 JAN 91			
16 SEP 90			
13 JAN 88	ADD NEW FENCE		
DATE	DESCRIPTION		

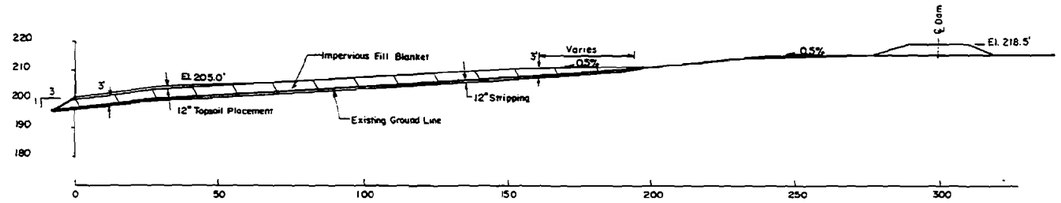
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

D. RICKETTS
K. MAIL
D. ANDERSON

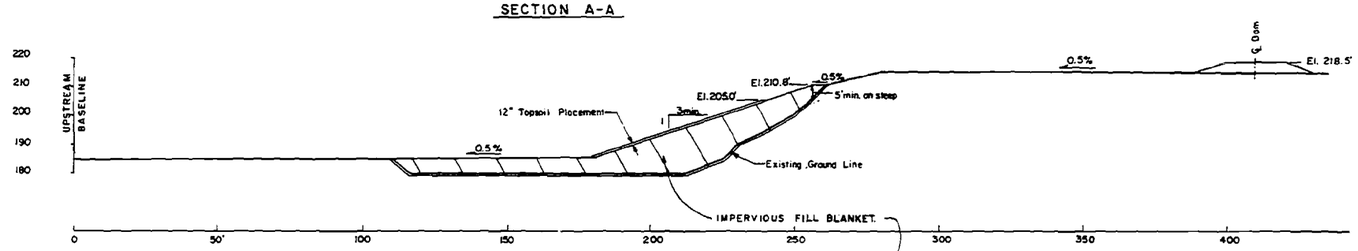
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
MAIN DAM AND DIKE "B"
PLAN, PROFILE, AND SECTION

CHIEF, ENG. DESIGN SECTION
27 MAR 87
SCALE: AS SHOWN
SHEET S-2
6
FILE NO. ME-12-4-19

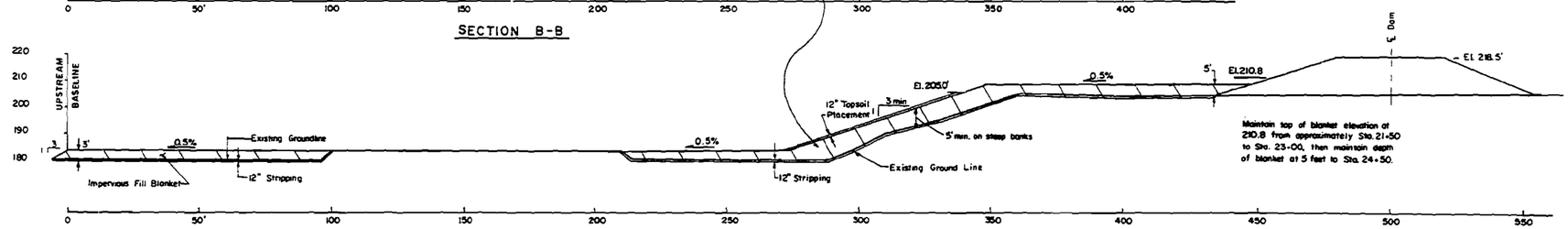
ATM-2



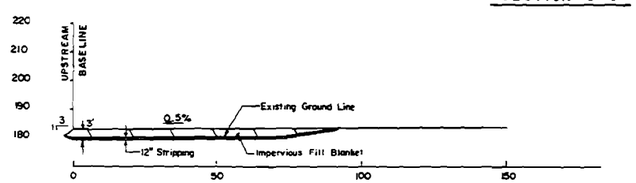
SECTION A-A



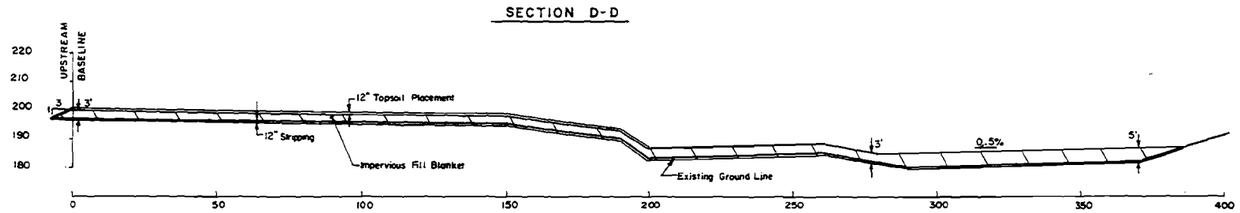
SECTION B-B



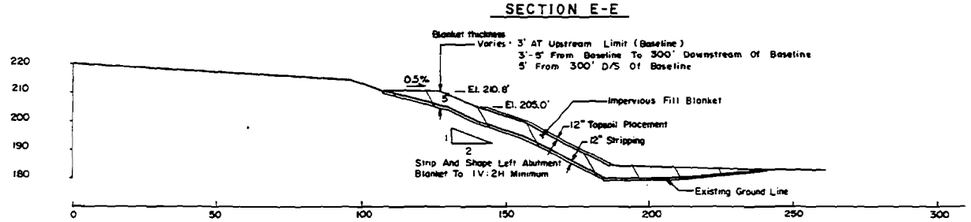
SECTION C-C



SECTION D-D



SECTION E-E



SECTION F-F
Scale: 1" = 20'

NOTES:

1. See plates S-1 and S-2 for locations of cross-section.
2. Topsoil extends from elevation 205.0 to elevation 192.5' or to toe of steep banks.
3. Locations of grade changes vary depending on local ground contours. Cross sections on this plate merely depict typical configurations for the blanket area fill. Actual grade change locations shall be determined by the contractor.

GRAPHIC SCALE
1" = 20' 0 10' 20' 40' 60' 80' 100'

AS-CONSTRUCTED

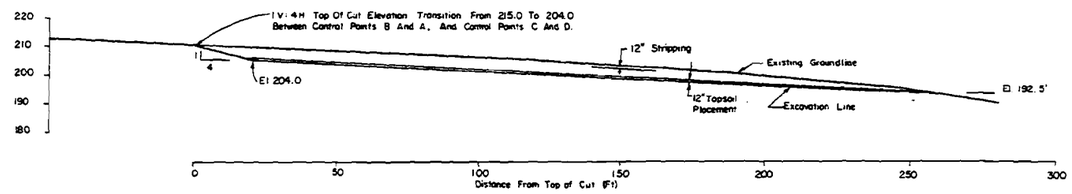
REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

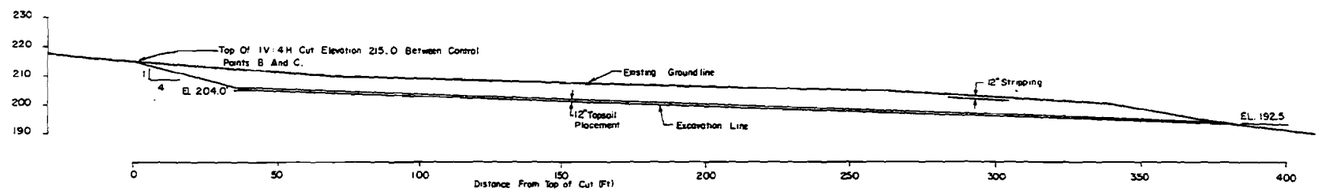
DESIGNED BY: D. Ricketts
DRAWN BY: K. Wahl
CHECKED BY: D. Anderson

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
IMPERVIOUS BLANKET AREA
CROSS-SECTIONS.

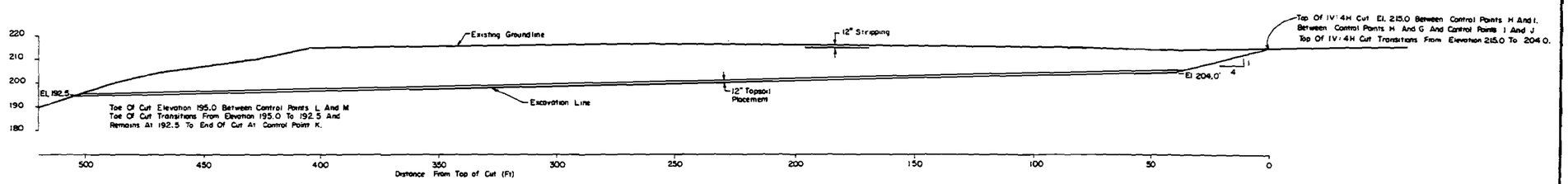
SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED: 27 Feb 1978
SCALE: AS SHOWN
SPEC. No. 6354A
SHEET: S-3 / 7
FILE No. ME-12-4-19



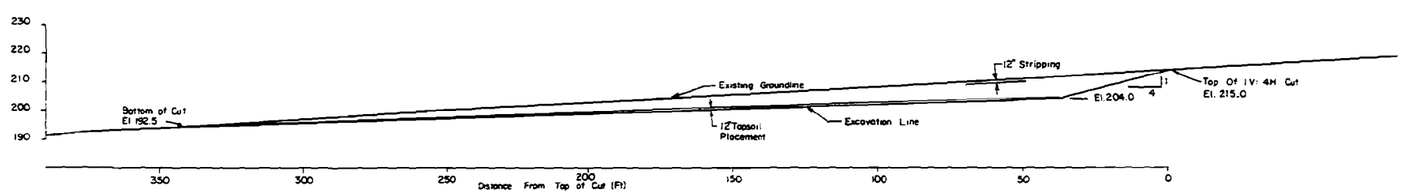
SECTION A'-A' - REQUIRED BORROW AREA
SCALE: 1" = 20'



SECTION B'-B' - REQUIRED BORROW AREA
SCALE: 1" = 20'



SECTION C'-C' - REQUIRED BORROW AREA
SCALE: 1" = 20'



SECTION D'-D' - REQUIRED BORROW AREA
SCALE: 1" = 20'

Note:
See sheet G-4 for cross section locations

GRAPHIC SCALE
1" = 20' 0 10' 20' 40' 60' 80' 100'

AS-CONSTRUCTED

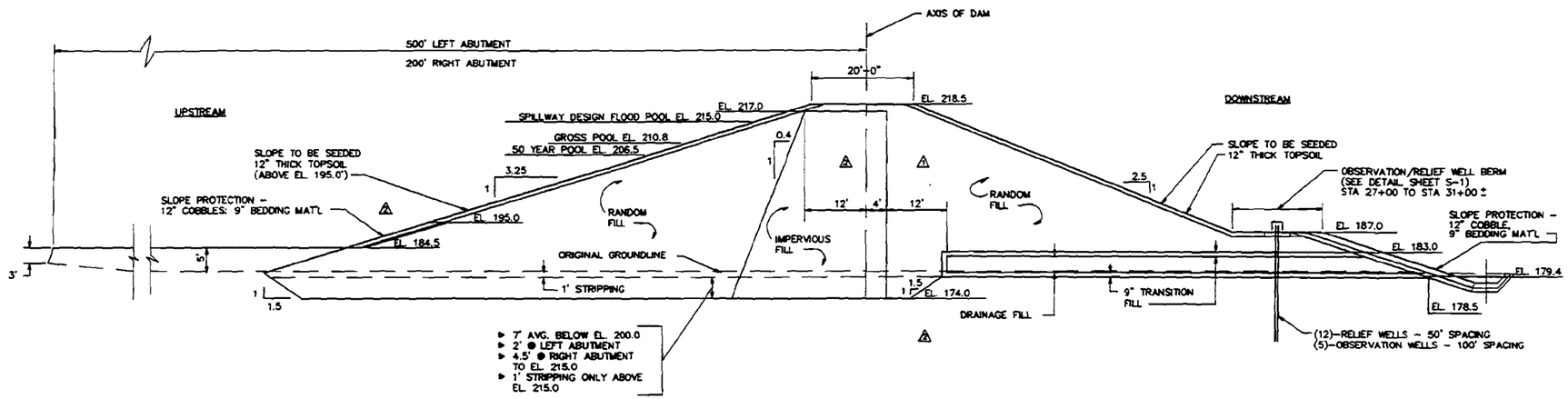
DIVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

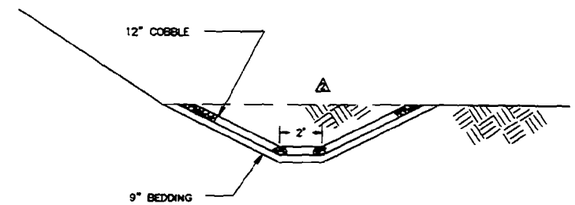
DESIGNED BY: D. Ricketts
DRAWN BY: K. Wohl
CHECKED BY: D. Anderson

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
REQUIRED BORROW AREA
CROSS SECTIONS

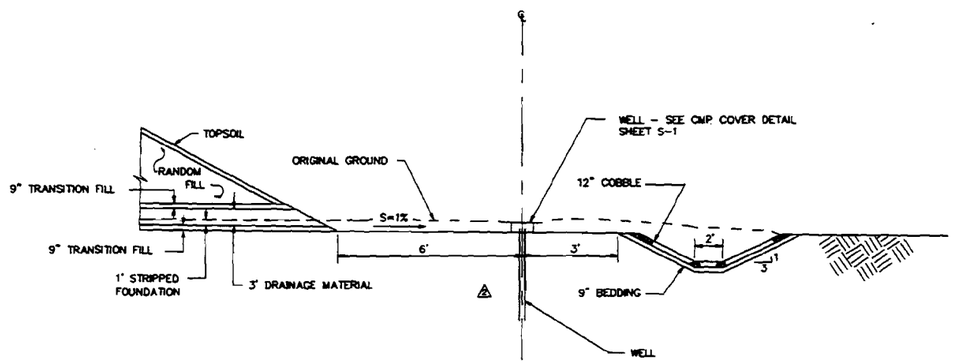
SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED: 27 Mar 87
SCALE: AS SHOWN
SHEET: S-4
8
SPEC. No. 6352A
FILE No. ME-12-4-19



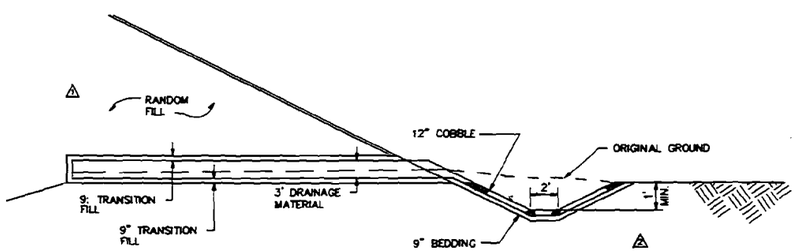
TYPICAL MAIN DAM SECTION
STA. 26+80 TO STA. 31+10
NOT TO SCALE



TOE DRAIN TRENCH
NOT TO SCALE



TYPICAL SECTION WITHOUT BERM
STA. 25+45 TO STA. 26+80
NOT TO SCALE



TYPICAL MAIN DAM SECTION
STA. 20+35 TO STA. 25+45 AND
STA. 31+10 TO STA. 32+60
BELOW ELEV. 206
NOT TO SCALE

GENERAL NOTES: (APPLIES TO ALL DRAWINGS)

1. ALL EXPOSED EDGES OF CONCRETE TO BE CHAMFERED 3/4" OR TOOLED AS DIRECTED UNLESS OTHERWISE NOTED.
2. CONTRACTOR SHALL PROVIDE STARTER WALL TO FACILITATE WALL FORMING OR FORM ALIGNERS APPROVED BY THE CONTRACTING OFFICER.
3. CONCRETE, f'c = 4,000 P.S.I.@ 28 DAYS UNLESS OTHERWISE NOTED. LEAN MIX CONCRETE, f'c = 2,000 P.S.I. @ 28 DAYS.
4. REINFORCING STEEL, fy = 60,000 P.S.I., GRADE 60.
5. CONCRETE FINISH, SEE SPECIFICATIONS.
6. UNLESS OTHERWISE NOTED, ALL DETAILS AND TOLERANCES SHALL BE IN ACCORDANCE WITH THE LATEST ACI STANDARD.
7. LAP SPLICE AND DEVELOPMENT LENGTHS FOR STEEL REINFORCEMENT ARE SHOWN BELOW, UNLESS OTHERWISE NOTED ON DRAWINGS:

LAP SPLICE LENGTH, INCHES:

	BAR SIZE	3	4	5	6	7	8	9	10	11
f'c = 3,000 p.s.i	TOP BAR	16	22	27	35	48	63	80	101	124
	REGULAR BAR	12	16	20	25	34	45	57	72	89
f'c = 4,000 p.s.i	TOP BAR	16	22	27	33	41	55	69	88	108
	REGULAR BAR	12	16	20	23	30	39	49	63	77

BAR DEVELOPMENT LENGTH, INCHES

f'c = 3,000 p.s.i	TOP BAR	13	17	21	27	37	49	61	78	96
	REGULAR BAR	12	12	15	19	26	35	44	56	68
f'c = 4,000 p.s.i	TOP BAR	13	17	21	25	32	42	53	67	83
	REGULAR BAR	12	12	15	18	23	30	38	48	59

FOR REINFORCEMENT SPACED AT 6" ON CENTER WITH AT LEAST 3" CLEAR COVER FROM FACE OF MEMBER TO EDGE OF BAR, A FACTOR OF 0.8 MAY BE APPLIED TO THE SAME ABOVE DEVELOPMENT LENGTHS.

8. CONCRETE FINISHES

FORMED SURFACES	
WATER PASSAGES	CLASS "C"
CONCRETE SURFACES AGAINST WHICH BACKFILL IS PLACED	CLASS "D"
OTHER EXPOSED SURFACES	CLASS "B"
UNFORMED SURFACES	
OGEE AND TOP OF RISER CRESTS	STEEL TROWEL
STILLING BASIN INVERT	STEEL TROWEL
TOP OF WALLS	STEEL TROWEL
OTHER UNFORMED SURFACES	WOOD FLOAT

GRAPHIC SCALES

1/8" = 1'-0" 0 5' 10' 15' 20' 25' 30' 35' 40'

1/4" = 1'-0" 0 5' 10' 15' 20'

AS-CONSTRUCTED

2	2DEC92	REVISED AS-CONSTRUCTED	DGG
1	12 JAN 91	MINOR ON TOE DRAIN	BMJ
0	28 OCT 89	MISCELLANEOUS CHANGES	EC
	21 AUG 89	SHOW REDUCTION IN TRANSITION FILL	EC

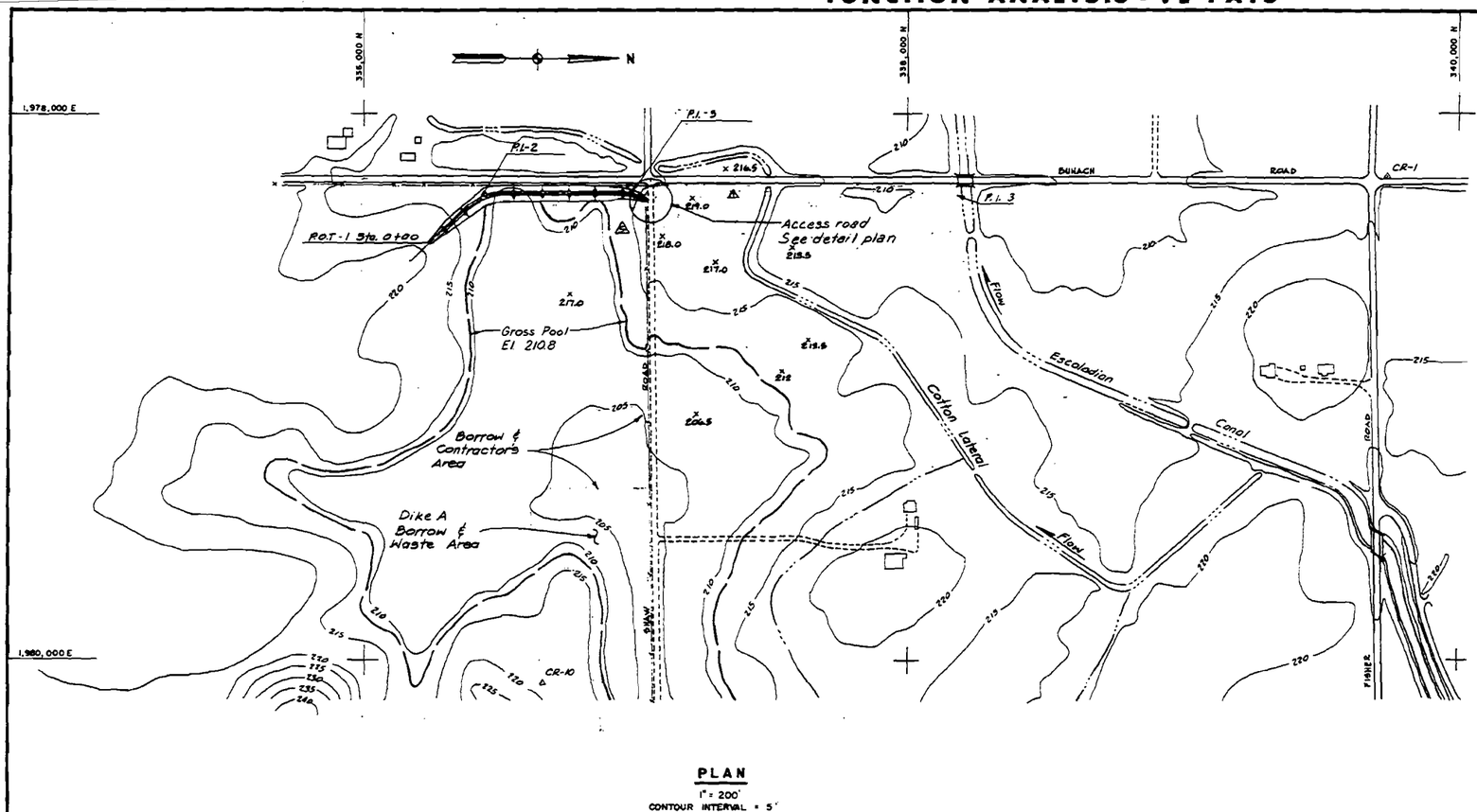
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: D. J. ANDERSON
DRAWN: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
MISCELLANEOUS DAM
CROSS SECTIONS

SUBMITTED: CHIEF, CIVIL PROJECTS SECTION B
DATE APPROVED: 5 Feb 89
SCALE: AS SHOWN
FILE No: 6352A
SHEET: S-4A
8A
ME-12-4-19

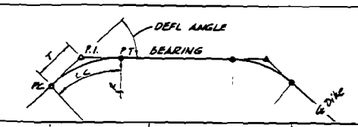
CASTLE.DWG 10/29/90 EC



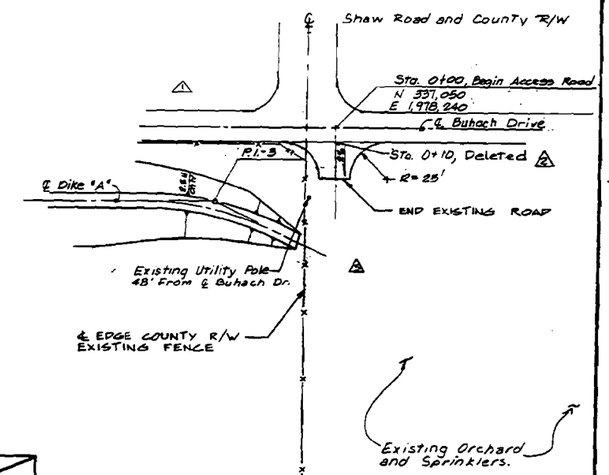
PLAN

1" = 200'
CONTOUR INTERVAL = 5'

DIKE ALIGNMENT DATA

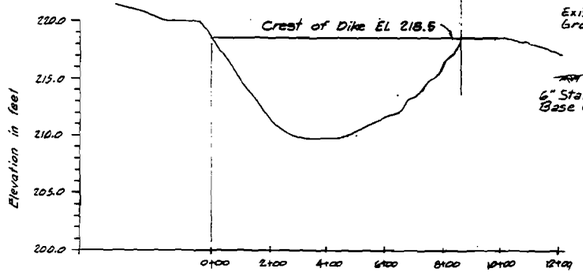


P.I. No	STA		BEARING	DEFL. ANGLE	P.I. COORD.
1	0+00		N 43° 00' 00" W		N 336,240.00 E 1,978,476.00
2	1+91.22 PC 3+41.32 PT	T = 78.78' LC = 150.10' R = 200'		43° 00' 00"	N 336,437.47 E 1,978,290.86
3	7+53.91 PC 8+42.19 PT	T = 46.63' LC = 91.28' R = 200'	DUE NORTH	26° 15' 00"	N 336,977.47 E 1,978,290.86
4	9+90.56 POT		N 26° 15' 00" E		N 337,147.88 E 1,978,374.09



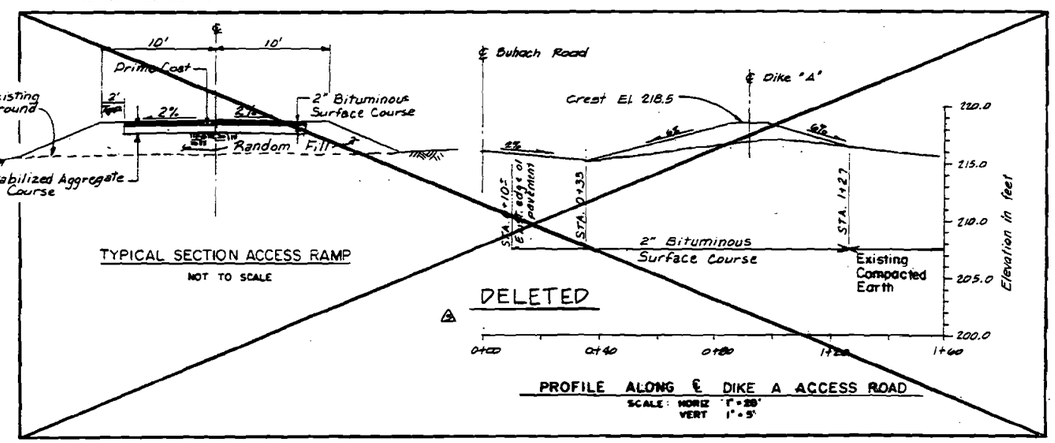
PLAN - ACCESS ROAD

SCALE: 1" = 40'



PROFILE ALONG ℄ OF DIKE

SCALE: HORIZ 1" = 200'
VERT 1" = 5'



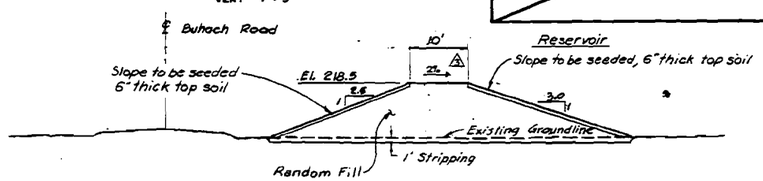
TYPICAL SECTION ACCESS RAMP

NOT TO SCALE

DELETED

PROFILE ALONG ℄ DIKE A ACCESS ROAD

SCALE: HORIZ 1" = 20'
VERT 1" = 5'



TYPICAL SECTION

not to scale

GRAPHIC SCALES

1" = 5'
1" = 20'
1" = 100'
1" = 40'

Notes:

1. For survey notes see sheet G-4
2. For bench mark data see sheet G-2
3. For property boundary fence see sheet R-6
4. For pavement joint detail see sheet R-1
5. See sheet S-1 for fence legend.

AS-CONSTRUCTED

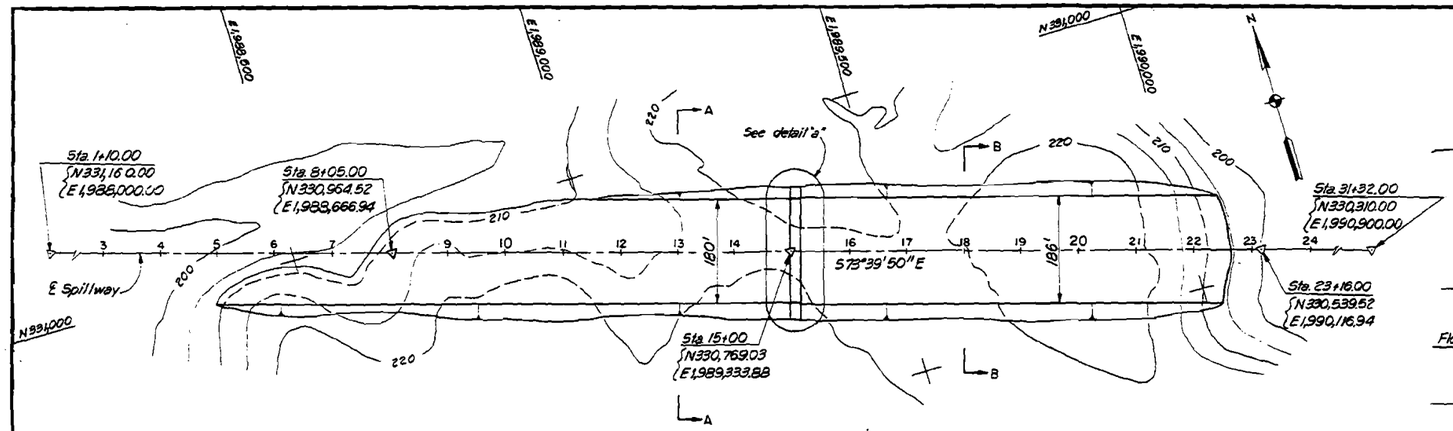
REVISION	DATE	DESCRIPTION	BY	IN
4	8 DEC 92	REVISED AS-CONSTRUCTED	RCS	DR
3	15 JAN 91	NOTES ON CANAL SPRINKLERS	BWJ	
2	25 OCT 90	ADD SLOPE ON DIKE	BWJ	GWB
1	9 NOV 89	ADD NOTE		GWB
	24 MAY 89	DELETE FENCE; SHOW ℄ COUNTY R/W	GL	GWB

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

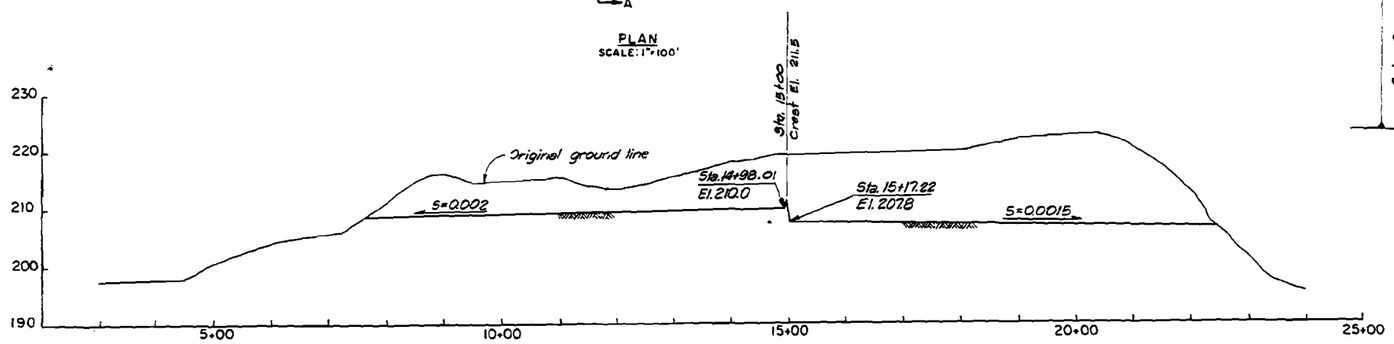
DESIGNED: T. PEARSON, L. RENNING
DRAWN: G. BUCKWELL
CHECKED: D. RICKETTS

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
DIKE A
PLAN, PROFILE, AND SECTION

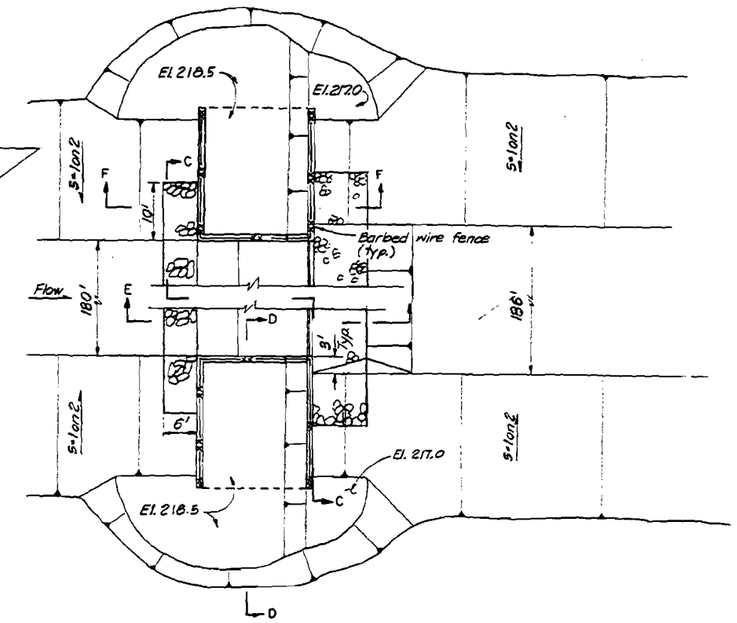
SUBMITTED: CHIEF, ENG. DESIGN SECTION
DATE APPROVED: 27 Nov 89
SCALE: AS SHOWN
SPEC. No. 63521
SHEET S-5 9
FILE No. ME-12-4-19



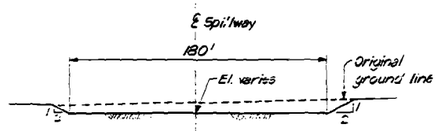
PLAN
SCALE: 1"=100'



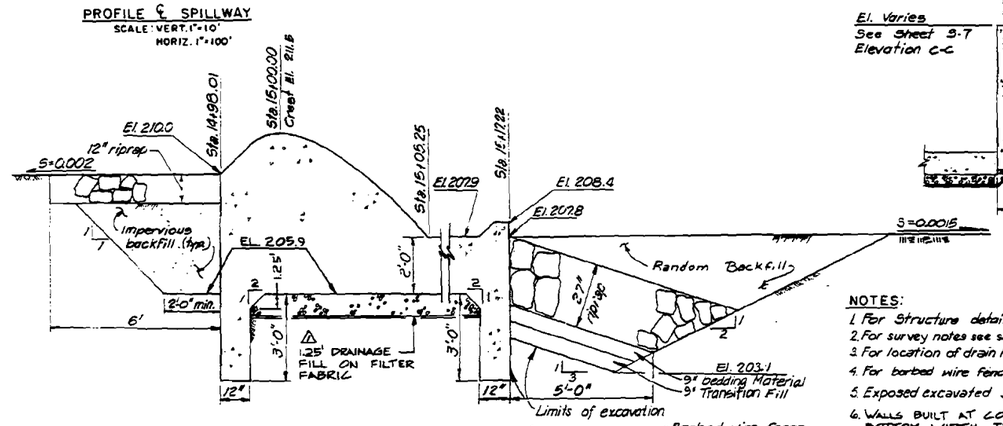
PROFILE ℄ SPILLWAY
SCALE: VERT. 1"=10'
HORIZ. 1"=100'



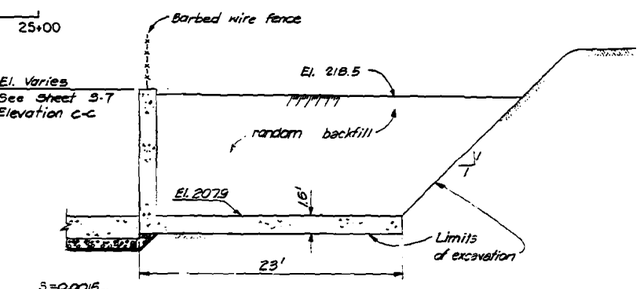
DETAIL "a"
SCALE: 1"=10'



SECTION A-A
SCALE: 1"=40'

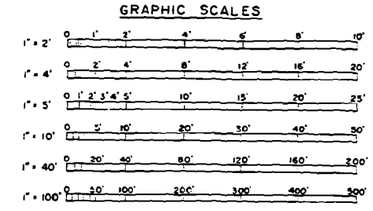


SECTION E-E
SCALE: 1"=2'



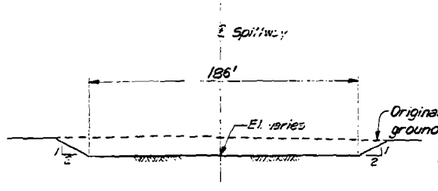
SECTION D-D
SCALE: 1"=5'

GRAPHIC SCALES

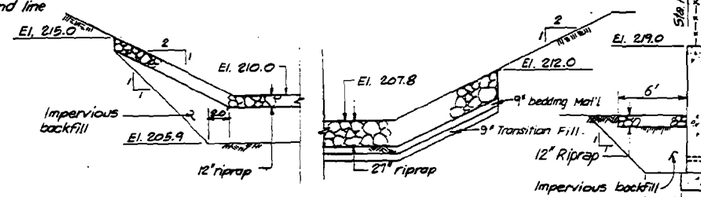


NOTES:

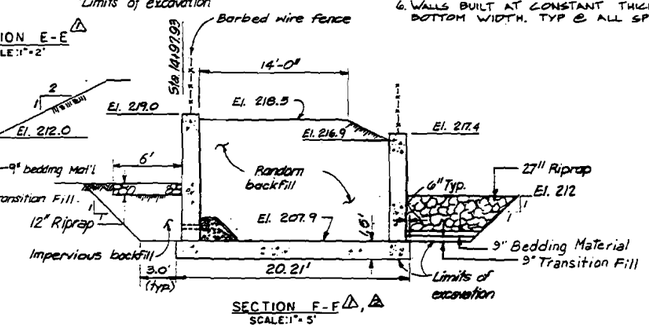
1. For Structure details see sheet S-7
2. For survey notes see sheet G-4
3. For location of drain hole see sheet S-7
4. For barbed wire fence details see sheet S-10
5. Exposed excavated surfaces are to be seeded.
6. WALLS BUILT AT CONSTANT THICKNESS TO BOTTOM WIDTH. TYP @ ALL SPILLWAYS.



SECTION B-B
SCALE: 1"=40'



SECTION C-C
SCALE: 1"=5'



SECTION F-F
SCALE: 1"=5'

AS-CONSTRUCTED

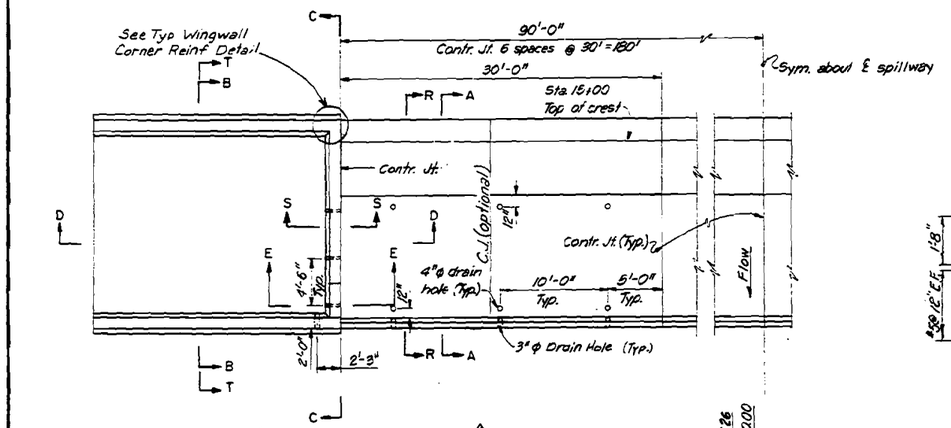
REVISION	DATE	DESCRIPTION		
B	2 DEC 86	REVISED AS-CONSTRUCTED		
A	10 DEC 80	Add drainage fill		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

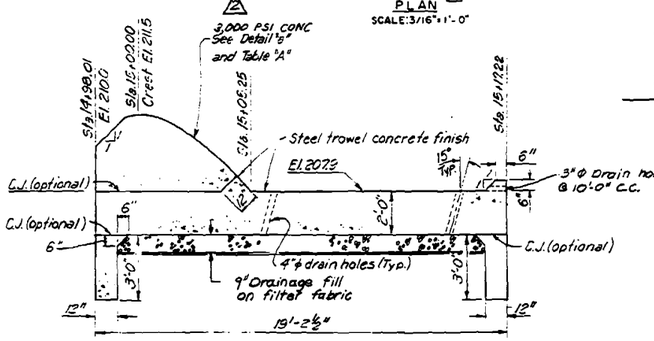
DRAWN: R. NORRIS
TRACED: L. SPRAGUE
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
SPILLWAY
PLAN, PROFILE, DETAIL, AND SECTIONS

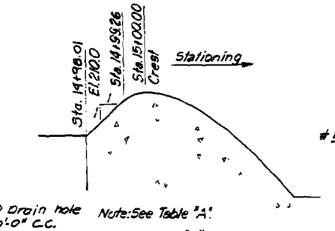
SUBMITTED: Johnnie N. Moore, Chief, Civil Design Section
DATE APPROVED: 1/7/87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET S-6 / 10
FILE No. ME-12-4-19



PLAN
SCALE: 3/16" = 1'-0"

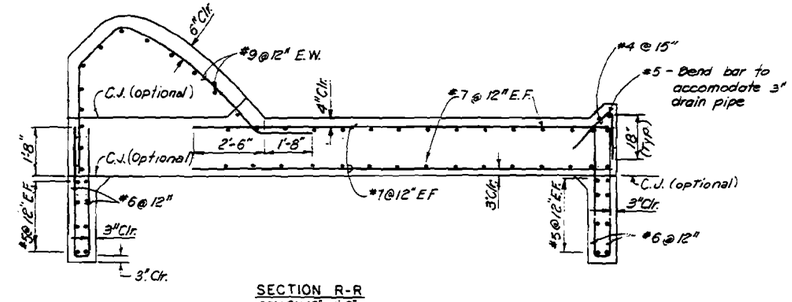


SECTION A-A
SCALE: 3/8" = 1'-0"

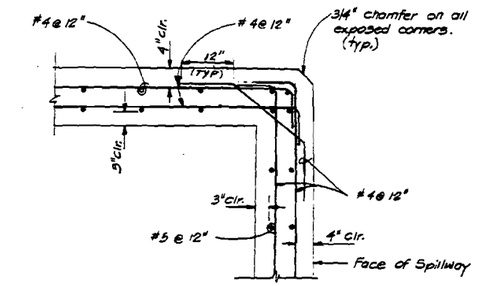


Note: See Table "A"

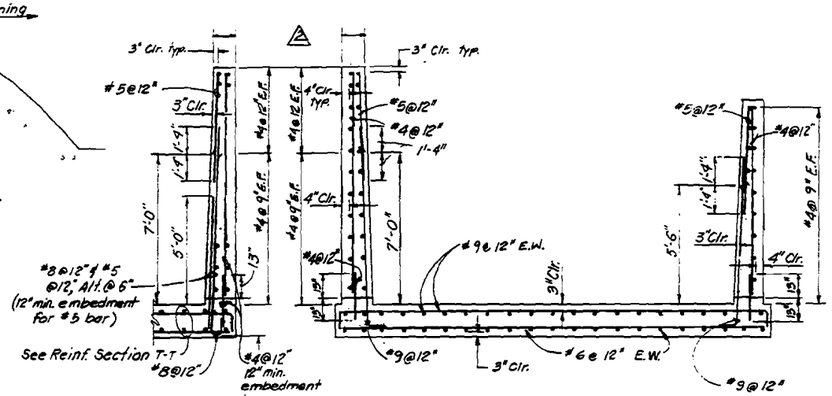
DETAIL "a"
SCALE: 1/2" = 1'-0"



SECTION R-R
SCALE: 1/2" = 1'-0"

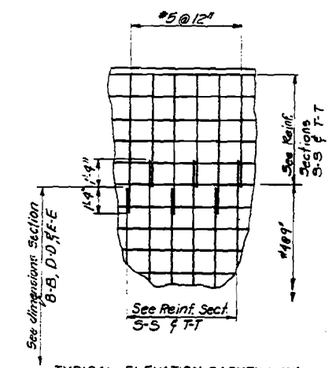


TYP. WINGWALL CORNER REINFORCING PLAN
SCALE: 1" = 1'-0"



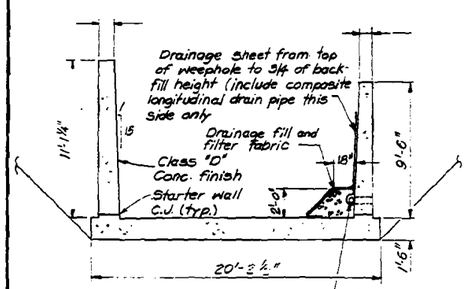
SECTION S-S
SCALE: 3/8" = 1'-0"

SECTION T-T
SCALE: 3/8" = 1'-0"

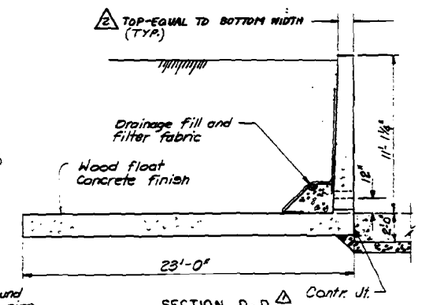


TYPICAL ELEVATION BACKFILL WALL
NOT TO SCALE

Notes:
1. All concrete shown on this sheet to have 3,000 p.s.i. compressive strength in 28 days
2. For starter wall and contr. Jt. details see sheet S-9
3. For General Notes, see sheet S-4A.



SECTION B-B
SCALE: 1/4" = 1'-0"



SECTION D-D
SCALE: 1/4" = 1'-0"

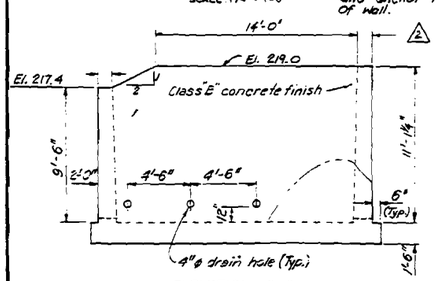
TABLE "A"	
STATION (x)	ELEVATION (y)
14+99.26	211.25
14+99.46	211.26
14+99.66	211.31
14+99.86	211.40
15+00.00	211.50
15+00.50	211.45
15+01.00	211.33
15+01.50	211.15
15+02.00	210.90
15+02.50	210.59
15+03.00	210.22
15+03.50	209.80
15+04.00	209.32
15+04.50	208.79
15+05.00	208.21
15+05.25	207.90

Equation 1 (Equation 2)

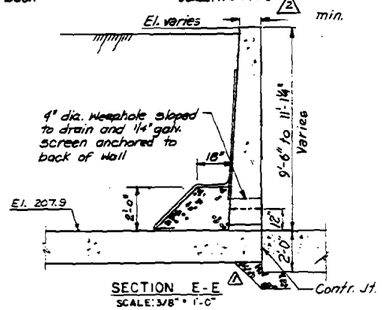
Note: If ℄ Stationing changes, the stations detailing the shape of the crest must be adjusted.

Equation 1 = $Y = 211.75 - \left[\frac{(-1.3841)(X-1499.26)^2}{4}\right]^{\frac{1}{2}}$

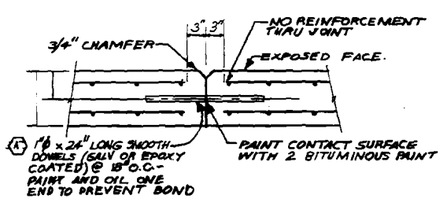
Equation 2 = $Y = 211.50 - .1674(X-1500)^{1.85}$



ELEVATION C-C
SCALE: 1/4" = 1'-0"

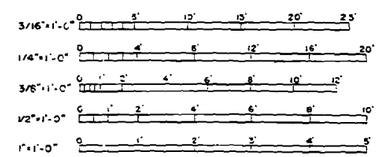


SECTION E-E
SCALE: 3/8" = 1'-0"



APPROACH CHANNEL & STILLING BASIN, WALL CONTRACTION JOINT DETAIL

GRAPHIC SCALES



AS-CONSTRUCTED

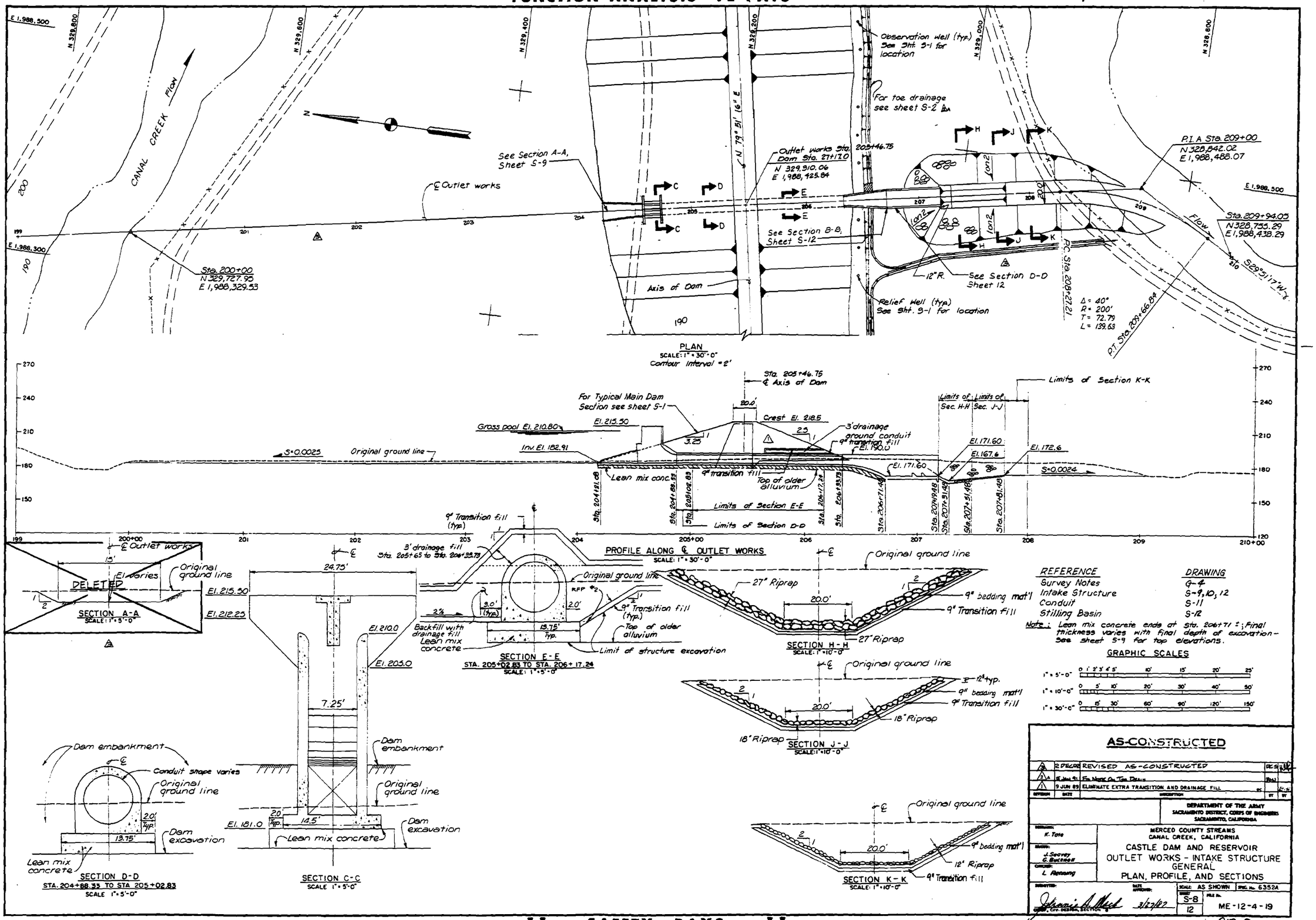
REVISION	DATE	DESCRIPTION	BY
2	2/DEC 92	REVISED AS-CONSTRUCTED	RLR
1	10 Feb 90	Revise typ. backfill and drainage details	RLR

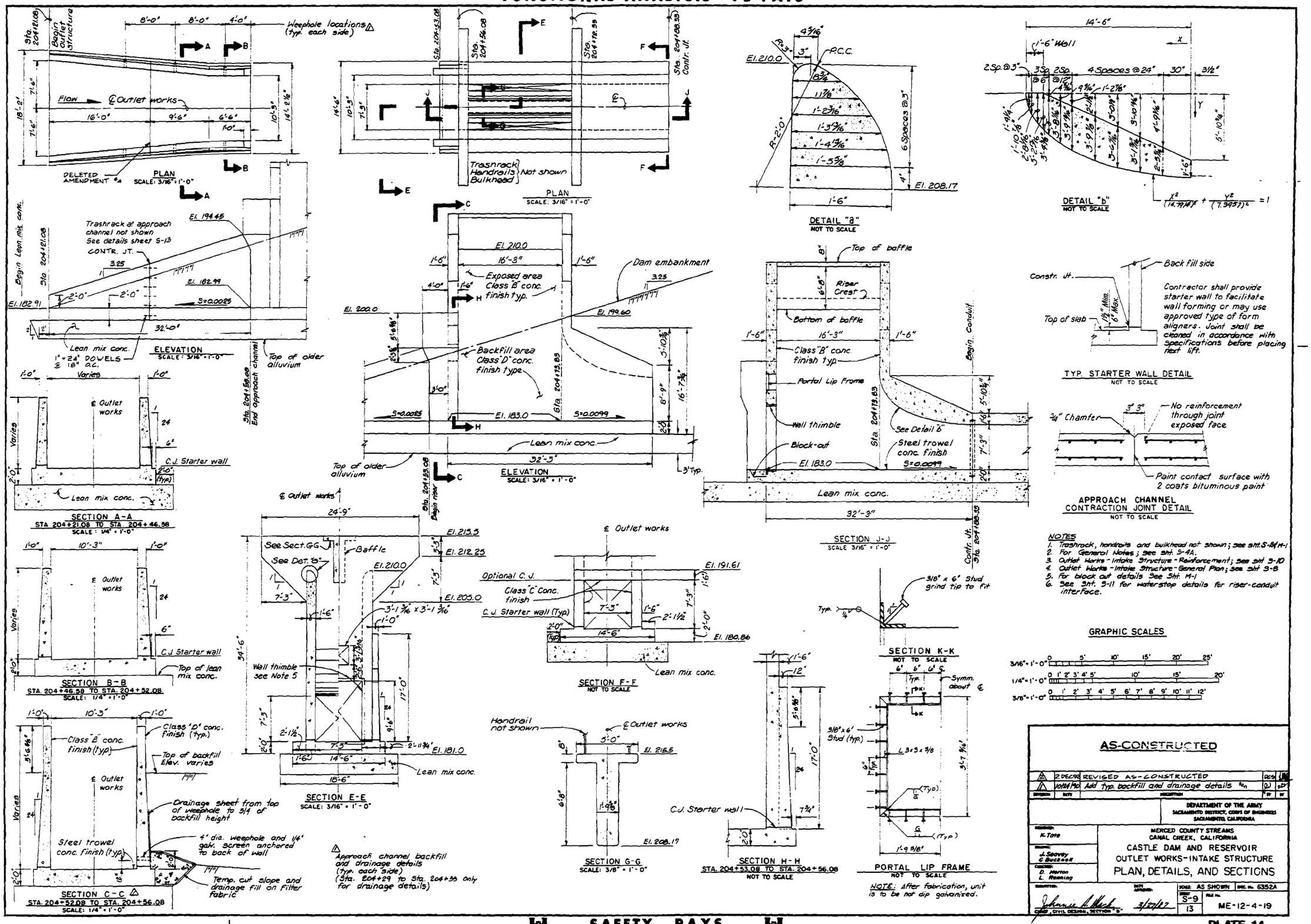
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

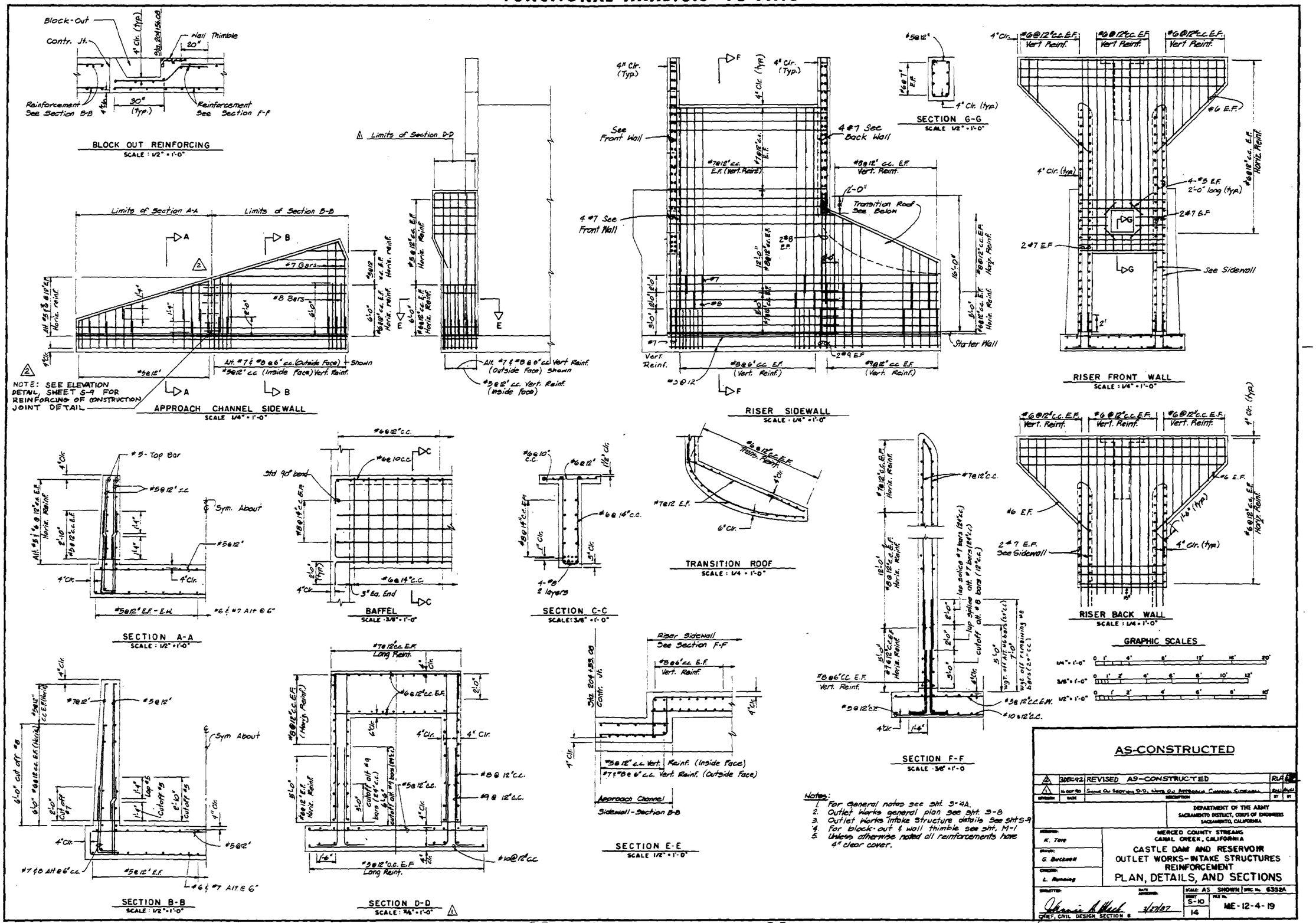
DESIGNED: R. NORRIS
DRAWN: L. SPRAGUE
CHECKED: L. RENNING

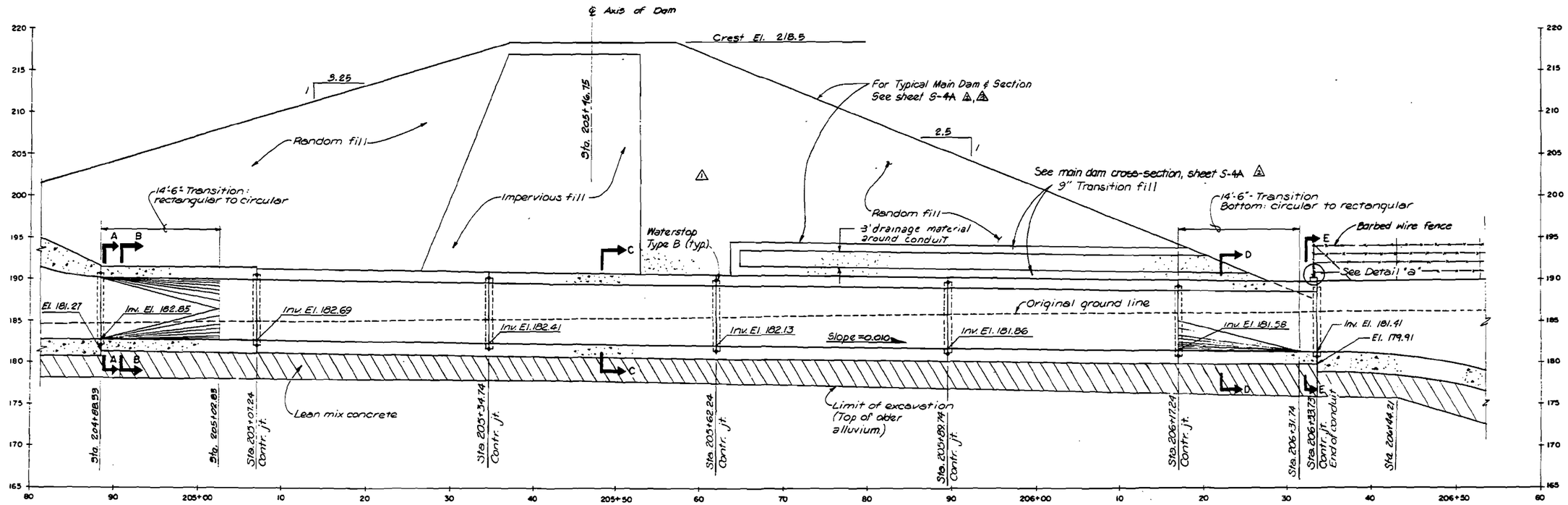
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
SPILLWAY
STRUCTURAL DIMENSIONS AND REINFORCEMENT

SUBMITTED: Johnnie N. Mack, CHIEF, CIVIL DESIGN SECTION "B"
DATE APPROVED: 3/22/92
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET S-7 11
FILE No. ME-12-4-19

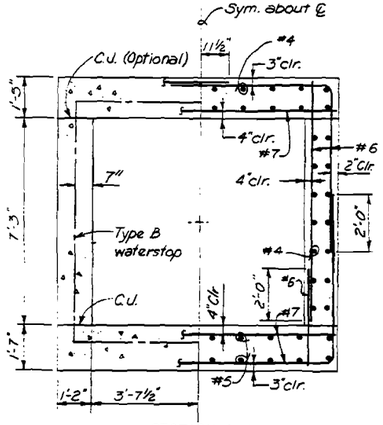

PLAN
SCALE: 1" = 30'-0"
Contour Interval = 2'
CANAL CREEK
Flow
See Section A-A, Sheet S-9
℄ Outlet works
Sta. 200+00
N 329,727.95
E 1,988,329.53
Axis of Dam
N 79° 51' 16" E
Outlet works Sta. 205+46.75
Dam Sta. 21+170
N 329,910.06
E 1,988,425.84
See Section B-B, Sheet S-12
Observation well (typ.) See Sht. S-1 for location
For toe drainage see sheet S-2
Relief Well (typ.) See Sht. S-1 for location
12"R.
See Section D-D Sheet 12
P.I. A Sta. 209+00
N 328,842.02
E 1,988,488.07
Sta. 209+94.05
N 328,755.29
E 1,988,438.29
S 29°51'17" W
P.C. Sta. 208+27.21
P.T. Sta. 209+66.94
Δ = 40°
R = 200'
T = 72.79
L = 139.63
PROFILE ALONG ℄ OUTLET WORKS
SCALE: 1" = 30'-0"
Sta. 205+46.75 ℄ Axis of Dam
For Typical Main Dam Section see sheet S-1
Gross pool El. 210.80
El. 215.50
Crest El. 218.5
3' drainage ground conduit
4" transition fill
El. 190.0
Inv. El. 182.91
S=0.0025
Original ground line
Lean mix conc.
Top of older alluvium
Limits of Section E-E
Limits of Section D-D
Limits of Sec. H-H
Limits of Sec. J-J
Limits of Section K-K
El. 171.60
El. 167.6
El. 172.6
S=0.0024
Sta. 204+21.68
Sta. 204+88.35
Sta. 205+02.83
Sta. 206+17.24
Sta. 206+93.73
Sta. 206+71.48
Sta. 207+91.48
Sta. 207+81.48
DELETED
SECTION A-A
SCALE: 1" = 5'-0"
El. varies
El. 215.50
El. 212.25
SECTION E-E
STA. 205+02.83 TO STA. 206+17.24
SCALE: 1" = 5'-0"
9" Transition fill (typ.)
3' drainage fill Sta. 205+65 to Sta. 206+33.73
Backfill with drainage fill
Lean mix concrete
Top of older alluvium
Limit of structure excavation
SECTION H-H
SCALE: 1" = 10'-0"
27" Riprap
9" bedding mat'l
9" Transition fill
SECTION J-J
SCALE: 1" = 10'-0"
18" Riprap
12" typ.
SECTION K-K
SCALE: 1" = 10'-0"
12" Riprap
SECTION C-C
SCALE 1" = 5'-0"
El. 210.0
El. 205.0
El. 181.0
Dam embankment
Dam excavation
Lean mix concrete
SECTION D-D
STA. 204+88.35 TO STA 205+02.83
SCALE 1" = 5'-0"
Conduit shape varies
REFERENCE
Survey Notes
Intake Structure
Conduit
Stilling Basin
DRAWING
G-4
S-9, 10, 12
S-11
S-12
Note: Lean mix concrete ends at Sta. 206+71 ± ; Final thickness varies with final depth of excavation - See sheet S-9 for top elevations.
GRAPHIC SCALES
1" = 5'-0"
1" = 10'-0"
1" = 30'-0"
AS-CONSTRUCTED
REVISED AS-CONSTRUCTED
ELIMINATE EXTRA TRANSITION AND DRAINAGE FILL
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
OUTLET WORKS - INTAKE STRUCTURE
GENERAL
PLAN, PROFILE, AND SECTIONS
SCALE: AS SHOWN
S-8
12
ME-12-4-19


PLAN
SCALE: 3/16" = 1'-0"
Weephole locations (typ. each side)
Flow
℄ Outlet works
DELETED AMENDMENT #4
Trashrack
Handrails
Bulkhead
Not shown
ELEVATION
SCALE: 3/16" = 1'-0"
Trashrack at approach channel not shown
See details sheet S-13
CONTR. JT.
Lean mix conc.
1" x 24" DOWELS @ 18" o.c.
Top of older alluvium
End approach channel
Exposed area Class "B" conc. finish typ.
Dam embankment
Backfill area Class "D" conc. finish type
Lean mix conc.
Top of older alluvium
SECTION A-A
STA 204+21.08 TO STA. 204+46.58
SCALE: 1/4" = 1'-0"
C.J. Starter wall
Lean mix conc.
SECTION B-B
STA. 204+46.58 TO STA. 204+52.08
SCALE: 1/4" = 1'-0"
Top of lean mix conc.
SECTION C-C
STA. 204+52.08 TO STA. 204+56.08
SCALE: 1/4" = 1'-0"
Class "B" conc. finish (typ)
Class "D" conc. finish (typ.)
Top of backfill Elev. varies
Drainage sheet from top of weephole to 3/4 of backfill height
Steel trowel conc. finish (typ)
4" dia. weephole and 1/4" galv. screen anchored to back of wall
Temp. cut slope and drainage fill on filter fabric
See Sect. GG
See Det. "B"
Baffle
Wall thimble see Note 5
SECTION E-E
SCALE: 3/16" = 1'-0"
Approach channel backfill and drainage details (typ. each side) (Sta. 204+29 to Sta. 204+35 only for drainage details)
DETAIL "a"
NOT TO SCALE
P.C.C.
DETAIL "b"
NOT TO SCALE
Top of baffle
Riser Crest
Bottom of baffle
Class "B" conc. finish typ.
Portal Lip Frame
Wall thimble
Block-out
Steel trowel conc. finish
See Detail "b"
Lean mix conc.
SECTION J-J
SCALE 3/16" = 1'-0"
Back fill side
Contractor shall provide starter wall to facilitate wall forming or may use approved type of form aligners. Joint shall be cleaned in accordance with specifications before placing next lift.
TYP. STARTER WALL DETAIL
NOT TO SCALE
No reinforcement through joint exposed face
Paint contact surface with 2 coats bituminous paint
APPROACH CHANNEL CONTRACTION JOINT DETAIL
NOT TO SCALE
NOTES
1. Trashrack, handrails and bulkhead not shown; see sht. S-8 & M-1
2. For General Notes; see sht. S-4A.
3. Outlet Works - Intake Structure - Reinforcement; see sht. S-10
4. Outlet Works - Intake Structure - General Plan; see sht. S-8
5. For block out details See Sht. M-1
6. See sht. S-11 for waterstop details for riser-conduit interface.
GRAPHIC SCALES
SECTION F-F
NOT TO SCALE
Optional C.J.
Class "C" Conc. finish
C.J. Starter wall (Typ)
Lean mix conc.
SECTION G-G
SCALE: 3/8" = 1'-0"
Handrail not shown
SECTION H-H
STA. 204+53.08 TO STA. 204+56.08
NOT TO SCALE
SECTION K-K
NOT TO SCALE
3/8" x 6" Stud grind tip to fit
3/8" x 6" Stud (typ.)
PORTAL LIP FRAME
NOT TO SCALE
NOTE: After fabrication, unit is to be hot dip galvanized.
AS-CONSTRUCTED
2 DEC 90 REVISED AS-CONSTRUCTED
10 Feb 90 Add typ. backfill and drainage details
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
OUTLET WORKS-INTAKE STRUCTURE
PLAN, DETAILS, AND SECTIONS
SCALE: AS SHOWN
S-9
13
ME-12-4-19

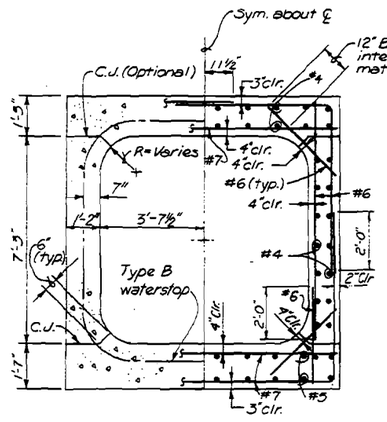

BLOCK OUT REINFORCING
SCALE : 1/2" = 1'-0"
Block-Out
Contr. Jt.
Wall Thimble
Reinforcement See Section B-B
Reinforcement See Section F-F
APPROACH CHANNEL SIDEWALL
SCALE 1/4" = 1'-0"
Limits of Section A-A
Limits of Section B-B
Limits of Section D-D
NOTE: SEE ELEVATION DETAIL, SHEET G-9 FOR REINFORCING OF CONSTRUCTION JOINT DETAIL
RISER SIDEWALL
SCALE : 1/4" = 1'-0"
SECTION G-G
SCALE 1/2" = 1'-0"
RISER FRONT WALL
SCALE : 1/4" = 1'-0"
See Front Wall
4#7 See Back Wall
4#7 See Front Wall
Transition Roof See Below
Starter Wall
See Sidewall
SECTION A-A
SCALE : 1/2" = 1'-0"
BAFFEL
SCALE : 3/8" = 1'-0"
SECTION C-C
SCALE : 3/8" = 1'-0"
TRANSITION ROOF
SCALE : 1/4" = 1'-0"
SECTION F-F
SCALE : 3/8" = 1'-0
RISER BACK WALL
SCALE : 1/4" = 1'-0"
GRAPHIC SCALES
SECTION B-B
SCALE : 1/2" = 1'-0"
SECTION D-D
SCALE : 3/8" = 1'-0"
Riser Sidewall See Section F-F
Approach Channel Sidewall-Section B-B
SECTION E-E
SCALE 1/2" = 1'-0"
Notes:
1. For general notes see sht. 3-4A.
2. Outlet Works general plan see sht. 3-8
3. Outlet Works Intake Structure details See sht 5-9
4. For block-out & wall thimble see sht. M-1
5. Unless otherwise noted all reinforcements have 4" clear cover.
AS-CONSTRUCTED
REVISED AS-CONSTRUCTED
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
OUTLET WORKS-INTAKE STRUCTURES
REINFORCEMENT
PLAN, DETAILS, AND SECTIONS
K. Tore
G. Buckwell
L. Ramsing
CHIEF, CIVIL DESIGN SECTION B
SCALE: AS SHOWN
5-10
14
ME-12-4-19



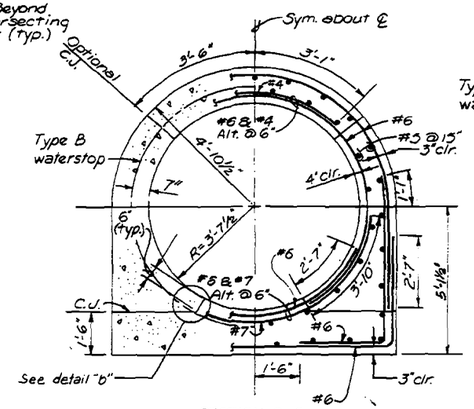
PROFILE ALONG C/L OUTLET WORKS
SCALE: VERT.: 1" = 5'-0"
HORIZ.: 1" = 5'-0"



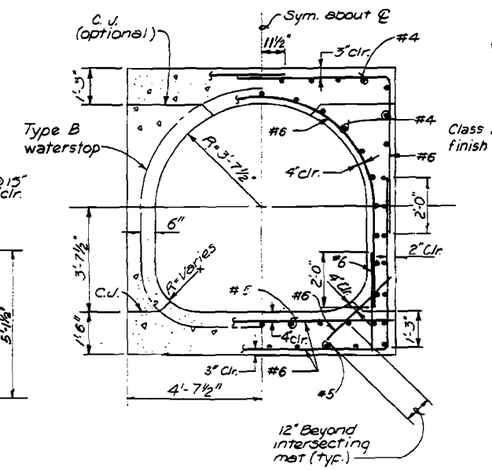
SECTION A-A
STA. 204+88.33 TO STA. 205+02.83
SCALE 1/2" = 1'-0"



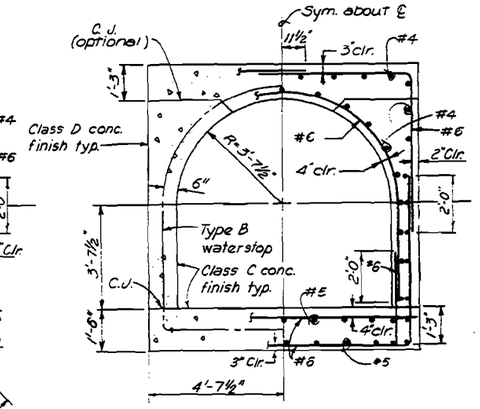
SECTION B-B
STA. 204+88.33 TO STA. 205+02.83
SCALE: 1/2" = 1'-0"



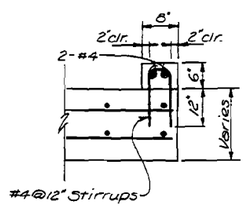
SECTION C-C
STA. 205+02.83 TO STA. 206+17.24
SCALE: 1/2" = 1'-0"



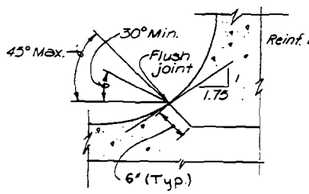
SECTION D-D
STA. 206+17.24 TO STA. 206+31.74
SCALE: 1/2" = 1'-0"



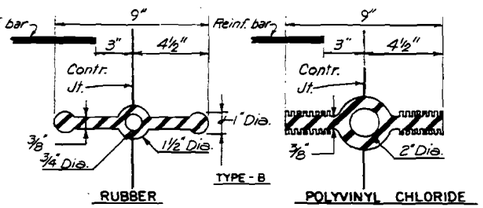
SECTION E-E
STA. 206+31.74 TO STA. 206+33.73
SCALE: 1/2" = 1'-0"



DETAIL "a"
NOT TO SCALE
NOTE: Fence not shown. See detail, Sht. S-13 △

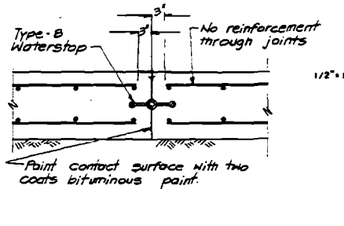


DETAIL "b"
NOT TO SCALE



RUBBER
POLYVINYL CHLORIDE

WATERSTOP DETAILS
NOT TO SCALE
(Use in contraction joints where shown)



CONDUIT CONTRACTION JOINT
NOT TO SCALE

GRAPHIC SCALES

1/2" = 1'-0" 0 1' 2' 3' 4' 5' 6' 7' 8' 9' 10'

NOTES
1. See sheet S-4A for General Notes.
2. All reinforcing steel spaced at 12" unless otherwise noted.
3. All Contr. Jt. this sheet require Type-B water stop.
4. For lean mix concrete see details sheet S-9

AS-CONSTRUCTED

△	3 DEC 92	REVISED AS-CONSTRUCTED	DCS	
△	16 OCT 90	CHANGED NOMENCLATURE, LOCATION OF TYPICAL MAIN DAM AND FRONT DETAIL		
△	13 JUL 89	REMOVE EXCESS DRAINAGE MATERIAL AND TRANSITION FILL		
REVISIONS	DATE	DESCRIPTION	CY	SY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: K. Wing
DRAWN: J. Seavey
CHECKED: D. Miner

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
OUTLET WORKS
CONDUIT
PROFILE, DETAILS, AND SECTIONS

SUBMITTED: Thomas A. Wade, CHIEF, CIV. DESIGN, SECTION "B"
DATE APPROVED: 3/29/87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET S-11 / 15
FILE No. ME-12-4-19

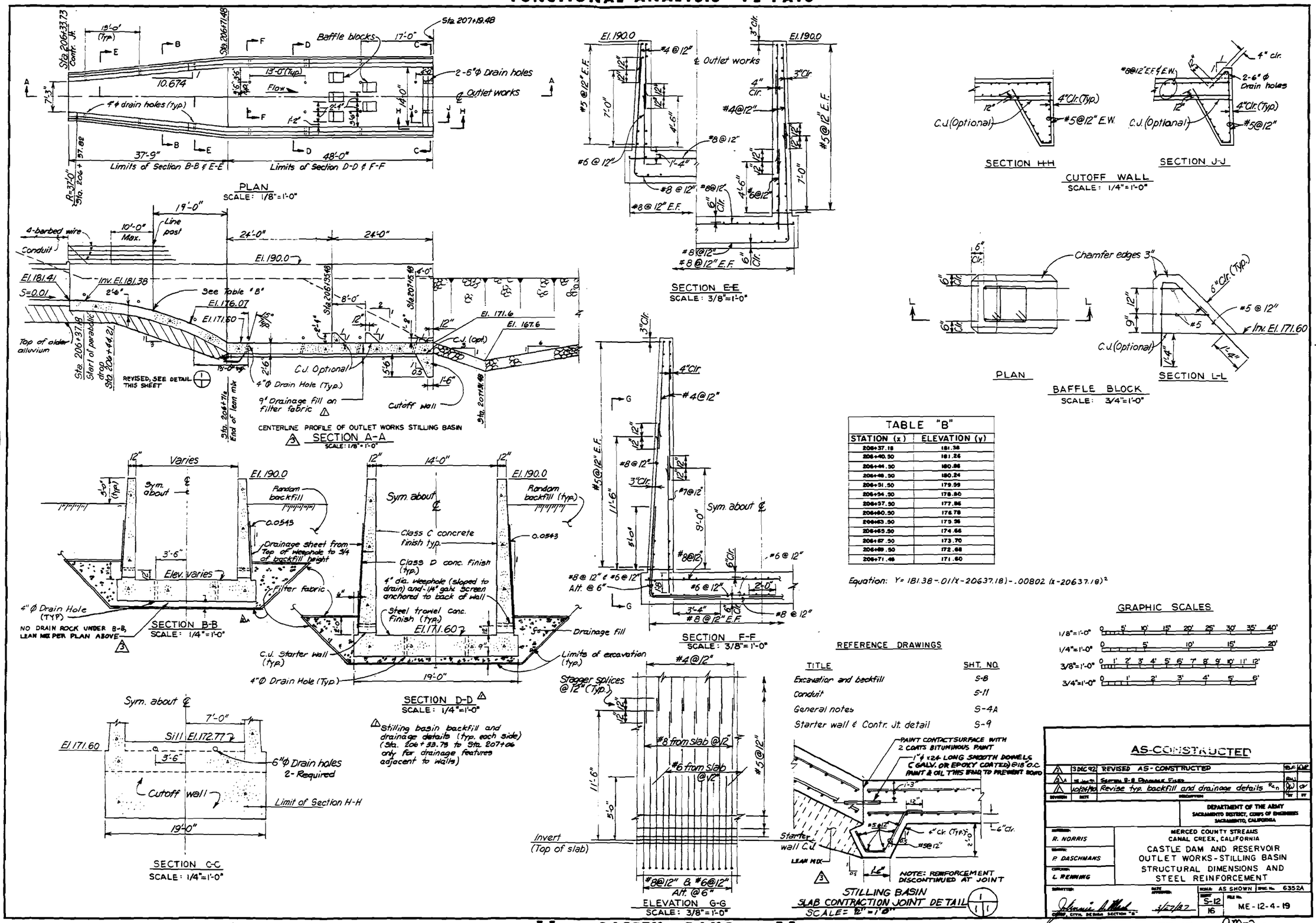
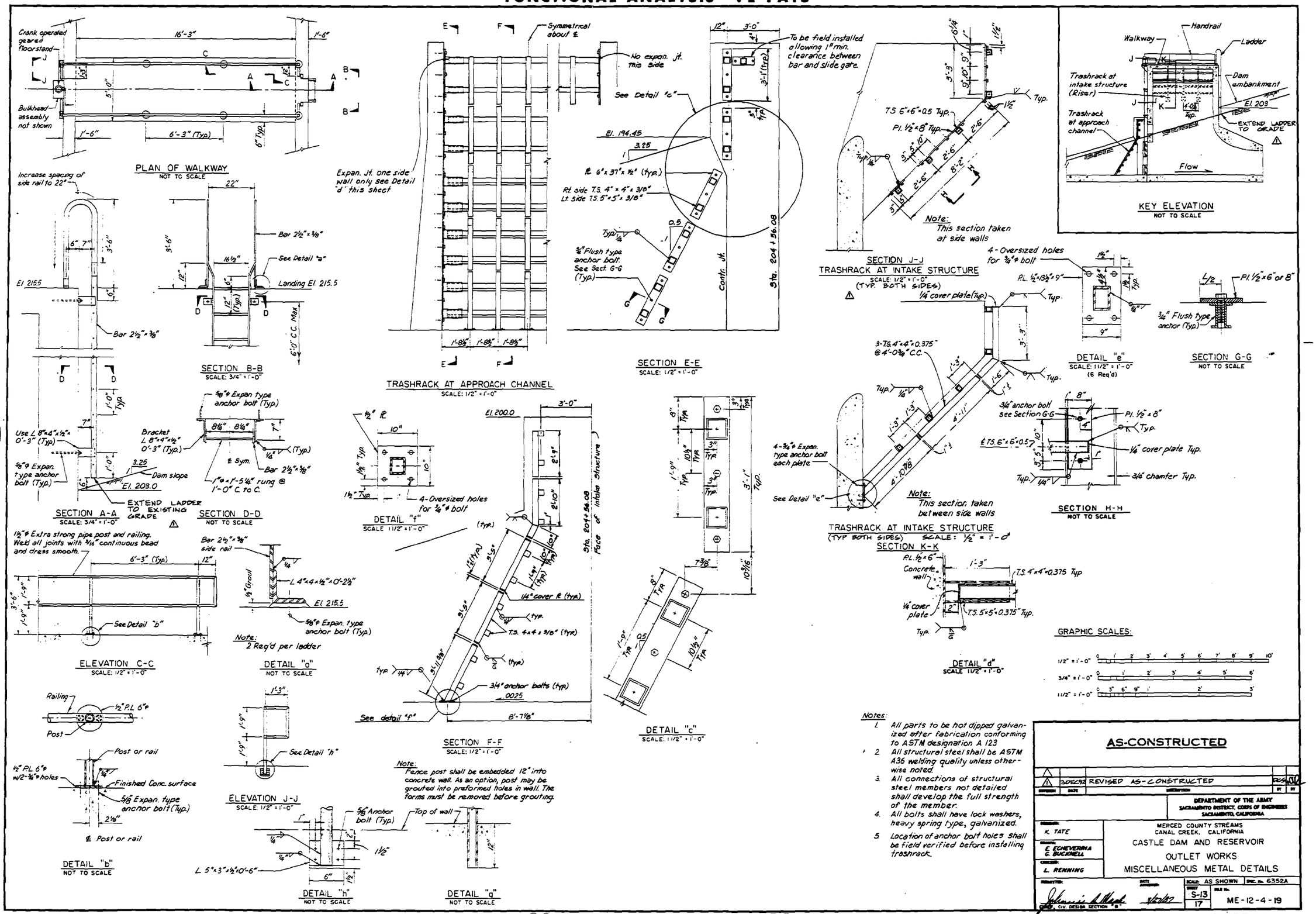


TABLE "B"	
STATION (x)	ELEVATION (y)
206+37.18	181.38
206+40.50	181.26
206+44.50	180.86
206+48.50	180.24
206+51.50	179.59
206+54.50	178.80
206+57.50	177.86
206+60.50	176.78
206+63.50	175.36
206+65.50	174.66
206+67.50	173.70
206+69.50	172.68
206+71.48	171.60

Equation: $Y = 181.38 - .01(X - 20637.18) - .00802\,(X - 20637.18)^2$

REFERENCE DRAWINGS

TITLE	SHT. NO.
Excavation and backfill	S-8
Conduit	S-11
General notes	S-4A
Starter wall & Contr. Jt. detail	S-9



Notes:

1. All parts to be hot dipped galvanized after fabrication conforming to ASTM designation A 123
2. All structural steel shall be ASTM A36 welding quality unless otherwise noted.
3. All connections of structural steel members not detailed shall develop the full strength of the member.
4. All bolts shall have lock washers, heavy spring type, galvanized.
5. Location of anchor bolt holes shall be field verified before installing trashrack.

AS-CONSTRUCTED

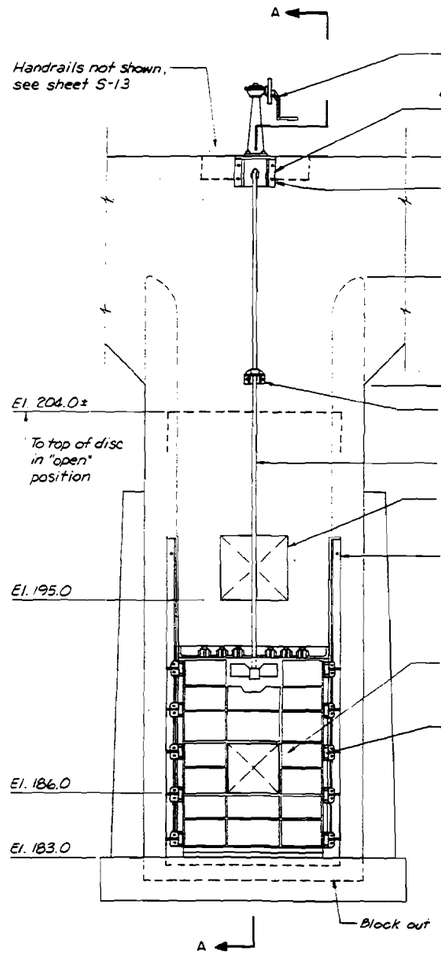
REVISION	DATE	DESCRIPTION	BY	BY
1	3 DEC 92	REVISED AS-CONSTRUCTED	DCS	DW

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

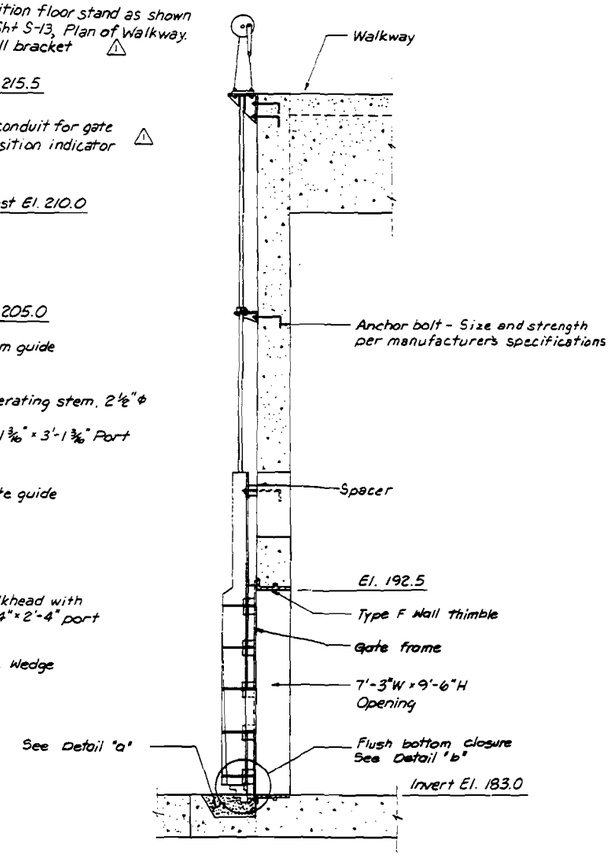
DESIGNED: K. TATE
DRAWN: E. ECHEVERRIA, G. BUCKNELL
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
OUTLET WORKS
MISCELLANEOUS METAL DETAILS

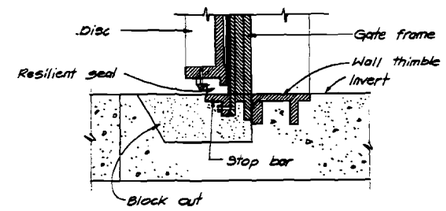
SUBMITTED: Chief, Civ. Design Section "B"
DATE APPROVED: 3/20/87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET S-13 of 17
FILE No. ME-12-4-19



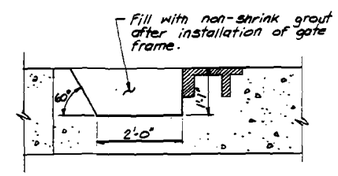
ELEVATION
SCALE : 3/8" = 1'-0"



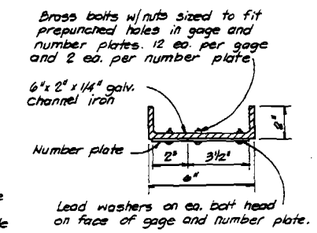
SECTION A-A
SCALE : 3/8" = 1'-0"



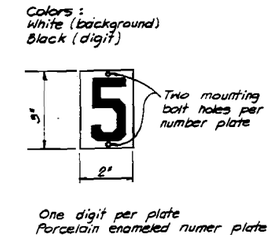
DETAIL "b"
NOT TO SCALE



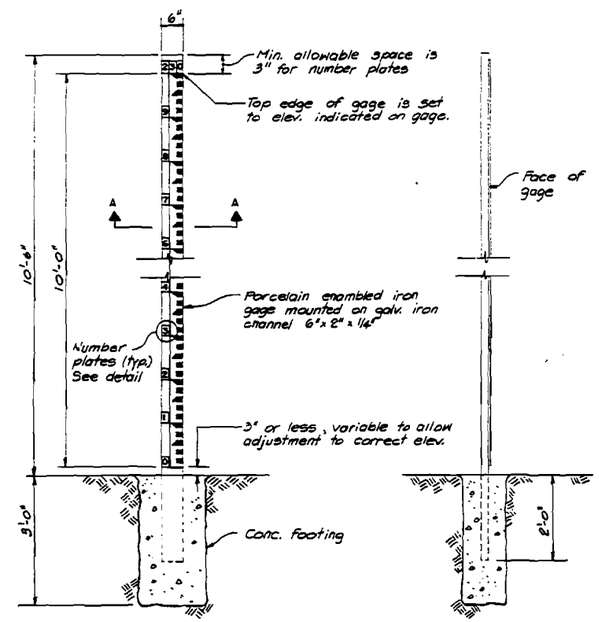
DETAIL "a"
NOT TO SCALE



SECTION A-A
NO SCALE



TYP NUMBER PLATE
NO SCALE



FRONT VIEW

SIDE VIEW

STAFF GAGE ASSEMBLY
NO SCALE

GRAPHIC SCALE

3/8" = 1'-0" 0 1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 11' 12'

Notes:
1. Bulkhead must be operable with minimum of 5' of head on U/S side.
2. The bulkhead must withstand a maximum head of 32 feet.
3. Gate furnished and installed by contractor.

Note:
1. Staff gage locations on sheet S-1
2. Gages to be final located in field.

AS-CONSTRUCTED

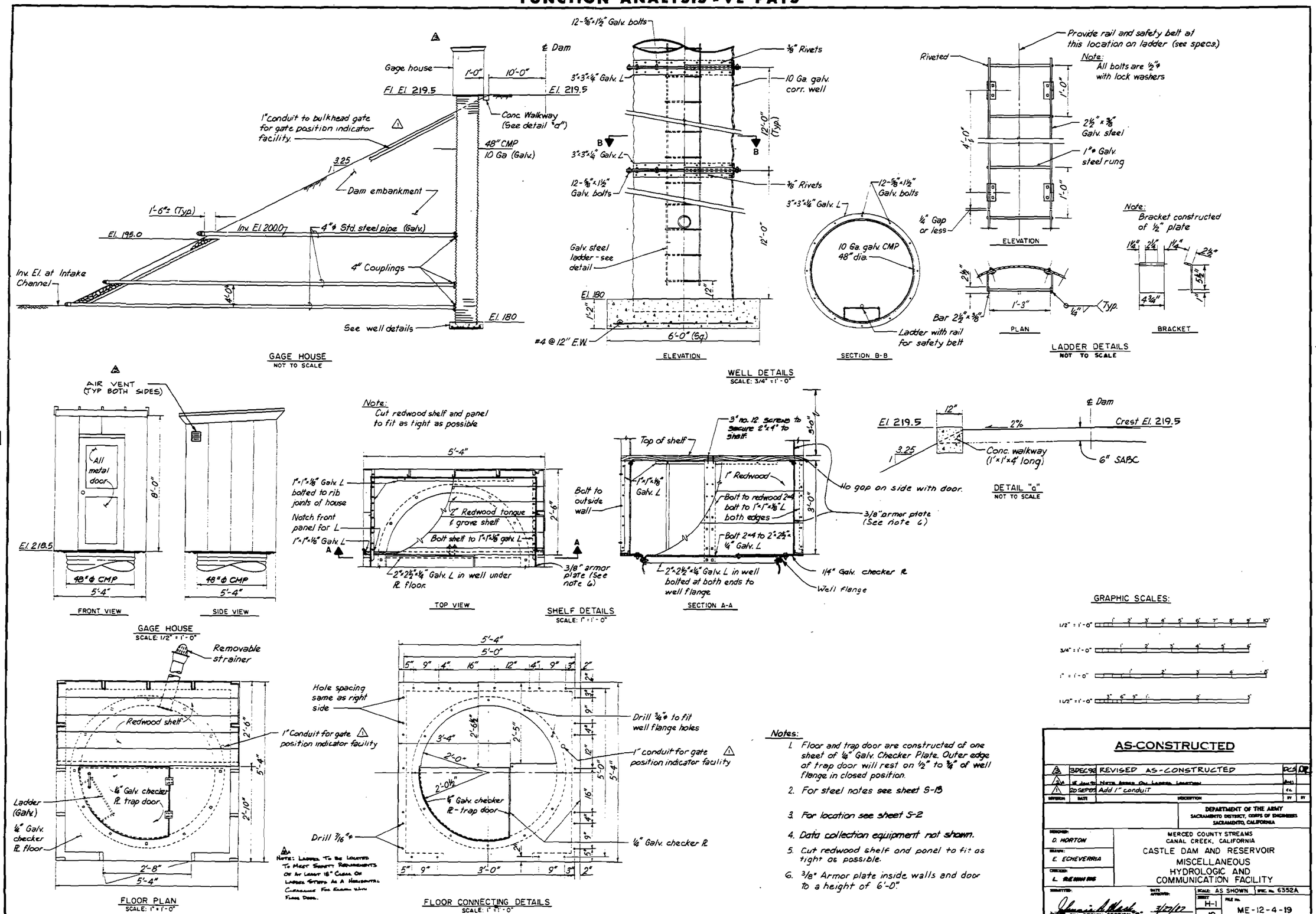
REVISION	DATE	DESCRIPTION	BY	BY
1	20 SEP 89	Changes to floor stand; add 1" conduit	CL	

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

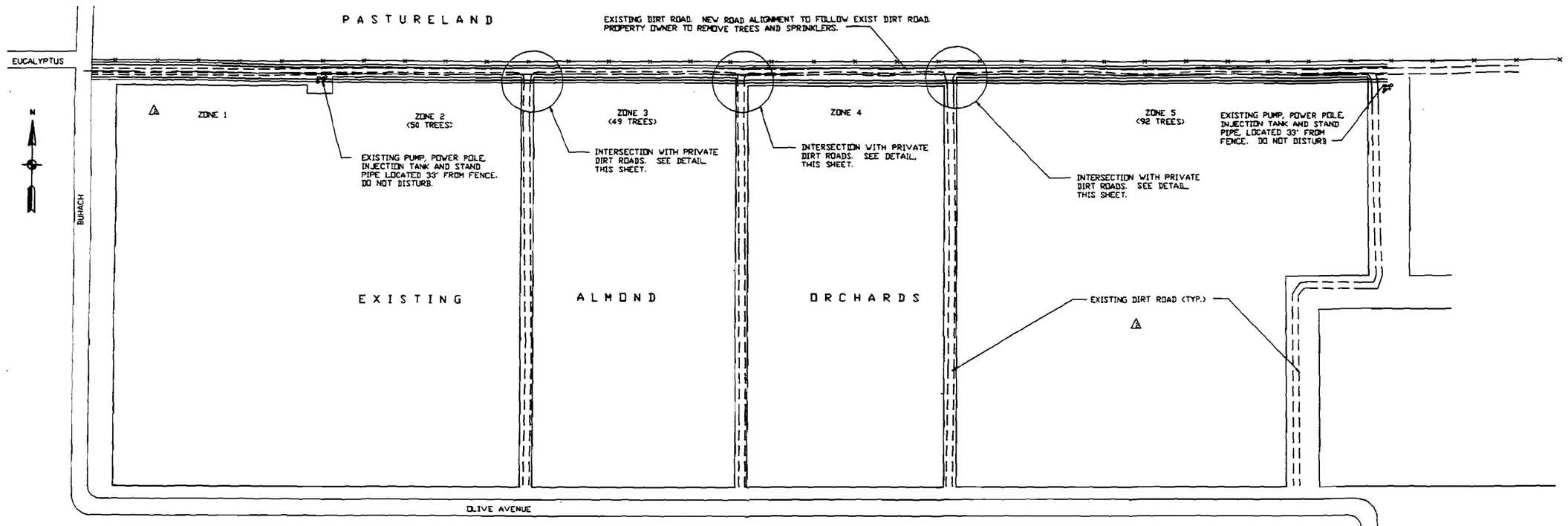
DESIGNED: K. TATE
DRAWN: J. YEE, G. BUCKNELL
CHECKED: L. REINING
SUBMITTED: Johnnie A. Mack, CHIEF, CIV. DESIGN SECTION "B"
DATE APPROVED: 3/27/87

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
MECHANICAL
GATE DETAIL & STAFF GAGE

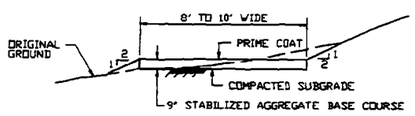
SCALE: 3/8" = 1'-0" | SPEC. No. 6352A
SHEET M-1 18 | FILE No. ME-12-4-19


GAGE HOUSE
NOT TO SCALE
Gage house
1'-0"
10'-0"
℄ Dam
Fl. El. 219.5
El. 219.5
Conc. Walkway (See detail "d")
1" conduit to bulkhead gate for gate position indicator facility.
48" CMP 10 Ga (Galv.)
3.25
1
Dam embankment
1'-6"± (Typ)
El. 195.0
Inv. El. 200.0
4"φ Std. steel pipe (Galv.)
4" Couplings
Inv. El. at Intake Channel
4'-0"
El. 180
See well details
ELEVATION
12-⅝"×1½" Galv. bolts
⅜" Rivets
3"×3"×¼" Galv. L
10 Ga. galv. corr. well
12'-0" (Typ.)
Galv. steel ladder - see detail
12'-0"
El. 180
1'-2"
#4 @ 12" E.W.
6'-0" (Sq.)
SECTION B-B
10 Ga. galv. CMP 48" dia.
Ladder with rail for safety belt
LADDER DETAILS
NOT TO SCALE
Provide rail and safety belt at this location on ladder (see specs.)
Riveted
Note: All bolts are ½"φ with lock washers
2½"×⅜" Galv. steel
1"φ Galv. steel rung
¼" Gap or less
Note: Bracket constructed of ½" plate
Bar 2½"×⅜"
1'-3"
Typ.
PLAN
BRACKET
WELL DETAILS
SCALE: 3/4" = 1'-0"
AIR VENT (TYP BOTH SIDES)
All metal door
8'-0"
El. 218.5
48"φ CMP
5'-4"
FRONT VIEW
SIDE VIEW
GAGE HOUSE
SCALE: 1/2" = 1'-0"
Note: Cut redwood shelf and panel to fit as tight as possible
5'-4"
1"×1"×⅛" Galv. L bolted to rib joints of house
Notch front panel for L
2" Redwood tongue & grove shelf
Bolt shelf to 1"×1"×⅛" galv. L
Bolt to outside wall
2'-6"
2"×2½"×¼" Galv. L in well under R. Floor
3/8" armor plate (See note 6)
TOP VIEW
SHELF DETAILS
SCALE: 1" = 1'-0"
3" no. 12 screws to secure 2"×4" to shelf.
Top of shelf
3'-0"
1" Redwood
Bolt to redwood 2×4 bolt to 1"×1"×⅛" L both edges
Bolt 2×4 to 2"×2½"×¼" Galv. L
No gap on side with door.
3/8" armor plate (See note 6)
2"×2½"×¼" Galv. L in well bolted at both ends to well flange
¼" Galv. checker R.
Well flange
SECTION A-A
12"
2%
℄ Dam
El. 219.5
Crest El. 219.5
3.25
1
Conc. walkway (1'×1'×4' long)
6" SABC
DETAIL "a"
NOT TO SCALE
GRAPHIC SCALES:
1/2" = 1'-0"
3/4" = 1'-0"
1" = 1'-0"
1 1/2" = 1'-0"
Removable strainer
Redwood shelf
1" Conduit for gate position indicator facility
¼" Galv. checker R. trap door
Ladder (Galv.)
¼" Galv. checker R. floor
2'-0"
5'-4"
2'-10"
2'-8"
5'-4"
FLOOR PLAN
SCALE: 1" = 1'-0"
Hole spacing same as right side
5'-4"
5'-0"
5" 9" 4" 16" 12" 14" 9" 3" 2"
3'-4"
2'-5"
2'-0"
2'-0½"
¼" Galv. checker R. - trap door
Drill ¾"φ to fit well flange holes
1" conduit for gate position indicator facility
Drill 7/16"φ
¼" Galv. checker R.
5" 9" 3'-0" 9" 3" 2"
FLOOR CONNECTING DETAILS
SCALE: 1" = 1'-0"
Notes:
1. Floor and trap door are constructed of one sheet of ¼" Galv. Checker Plate. Outer edge of trap door will rest on ½" to ¾" of well flange in closed position.
2. For steel notes see sheet S-13
3. For location see sheet S-2
4. Data collection equipment not shown.
5. Cut redwood shelf and panel to fit as tight as possible.
6. 3/8" Armor plate inside walls and door to a height of 6'-0".
AS-CONSTRUCTED
3 DEC 92 REVISED AS-CONSTRUCTED
2 20 SEP 89 Add 1" conduit
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
D. HORTON
E. ECHEVERRIA
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
MISCELLANEOUS
HYDROLOGIC AND
COMMUNICATION FACILITY
SCALE: AS SHOWN
SPEC. No. 6352A
H-1
19
ME-12-4-19

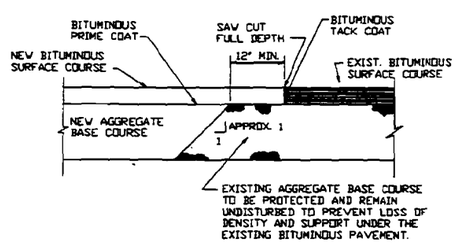
FUNCTION ANALYSIS — VE PAYS



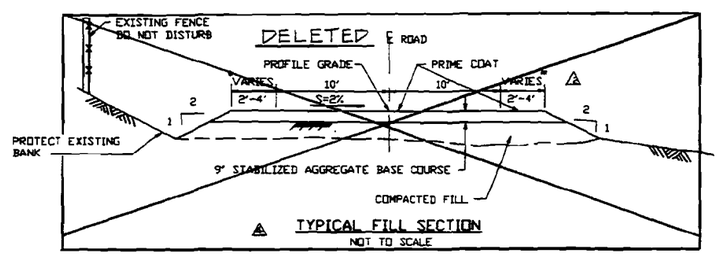
LOCATION PLAN
NOT TO SCALE



PRIVATE ROAD INTERSECTION
NOT TO SCALE

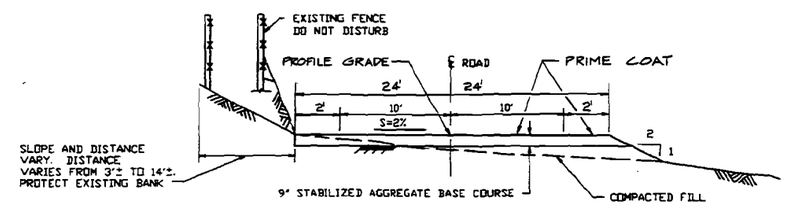


PAVEMENT JOINT DETAIL
NOT TO SCALE

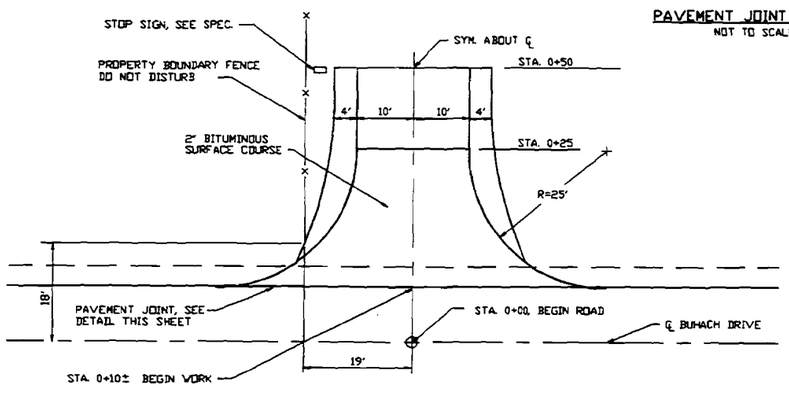


TYPICAL FILL SECTION
NOT TO SCALE

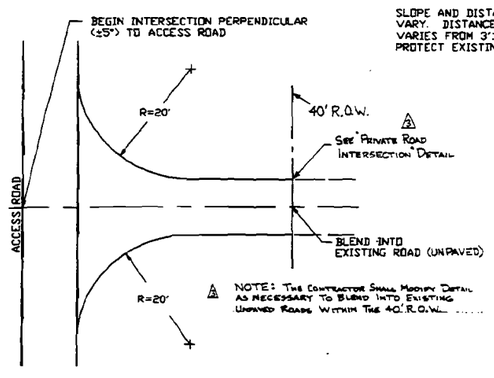
AS REQUIRED TO MATCH TOE OF EXISTING BANK AND 40' R.O.W.



TYPICAL SECTION
NOT TO SCALE



DETAIL
INTERSECTION AT BUHACH AVENUE
NOT TO SCALE



NOTE: THE CONTRACTOR SHALL MODIFY DETAIL AS NECESSARY TO BLEND INTO EXISTING UNPAVED ROADS WITHIN THE 40' R.O.W.

INTERSECTION WITH PRIVATE DIRT ROADS
NOT TO SCALE

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	DRAWN	CHECKED
3	3DEC92	REVISED AS-CONSTRUCTED	DCG	[illegible]
2	24 OCT 90	ADD NOTES	[illegible]	[illegible]
1	13 JUL 89	SHOW ROAD ALIGNMENT; ADD DETAIL	[illegible]	[illegible]
0	24 MAY 89	NEW SHEET	[illegible]	[illegible]

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

ACCESS ROAD
PLAN, INTERSECTION AND SECTIONS

SUBMITTED: Donald Hart, CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED: 11 July 89
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: R-1
20
FILE No.: ME-12-4-19

SCALE: 1=1
DATE: 17 JUN 89
CADFILE: CR-1

SAFETY3 PAYS

PLATE 21

FUNCTION ANALYSIS – VE PAYS

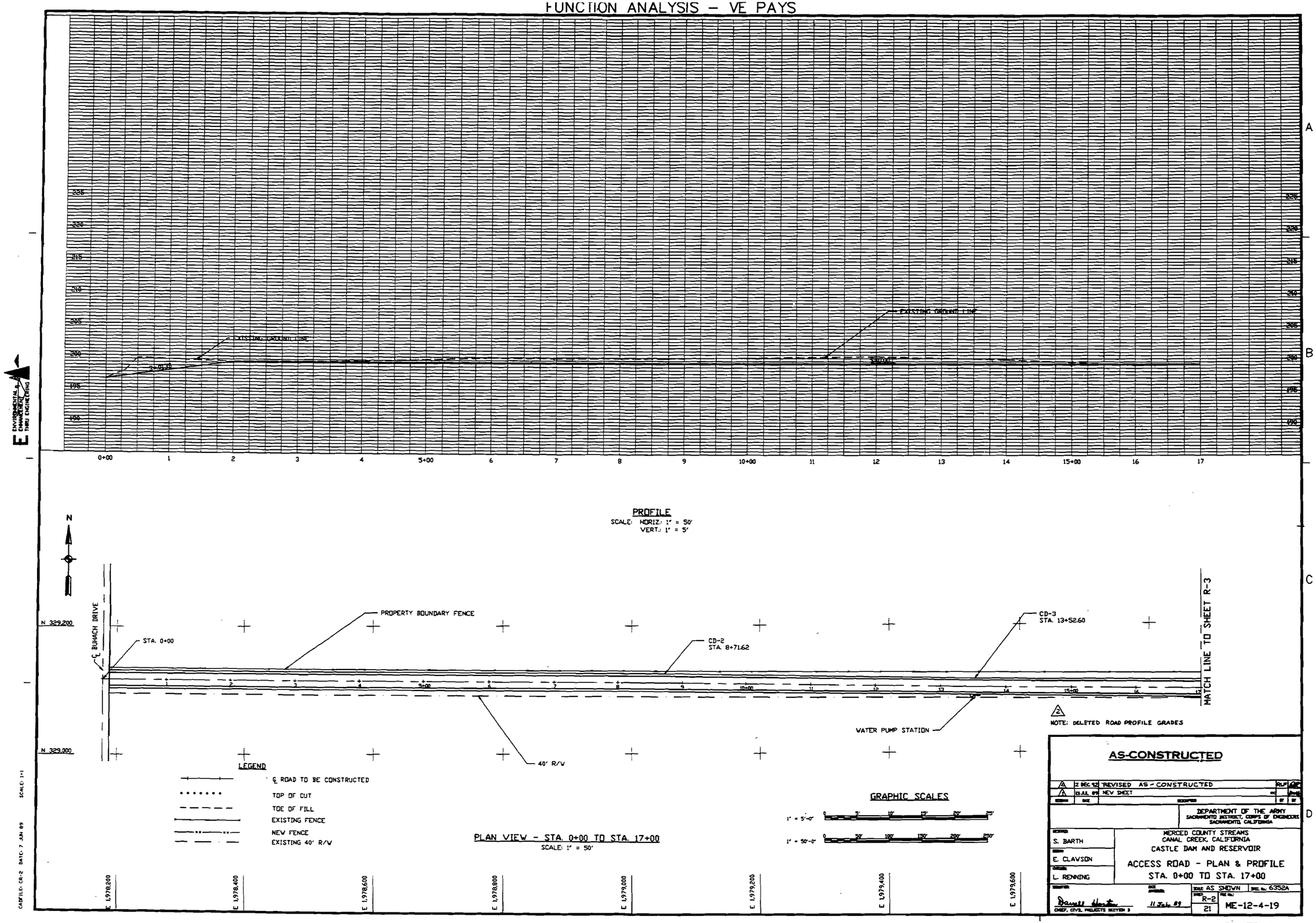
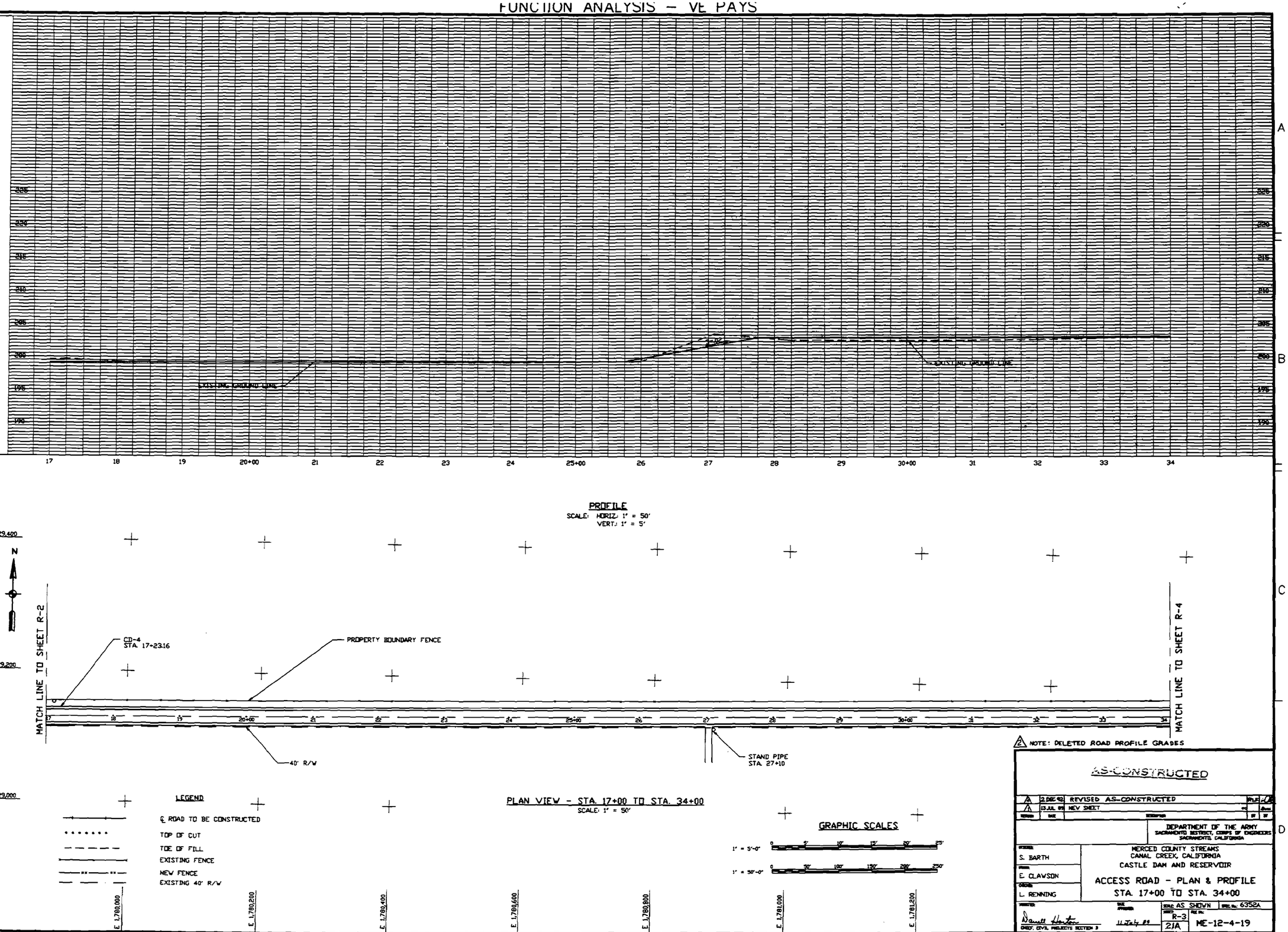


PLATE 22


EXISTING GROUND LINE
EXISTING GROUND LINE
17
18
19
20+00
21
22
23
24
25+00
26
27
28
29
30+00
31
32
33
34
PROFILE
SCALE: HORIZ: 1" = 50'
VERT: 1" = 5'
N 329,400
N 329,200
N 329,000
N
MATCH LINE TO SHEET R-2
MATCH LINE TO SHEET R-4
CD-4
STA. 17+23.16
PROPERTY BOUNDARY FENCE
40' R/W
STAND PIPE
STA. 27+10
NOTE: DELETED ROAD PROFILE GRADES
LEGEND
℄ ROAD TO BE CONSTRUCTED
TOP OF CUT
TOE OF FILL
EXISTING FENCE
NEW FENCE
EXISTING 40' R/W
PLAN VIEW – STA. 17+00 TO STA. 34+00
SCALE: 1" = 50'
GRAPHIC SCALES
1" = 5'-0"
1" = 50'-0"
E 1,780,000
E 1,780,200
E 1,780,400
E 1,780,600
E 1,780,800
E 1,781,000
E 1,781,200
1
2
3
4
A
B
C
D
AS-CONSTRUCTED
2 DEC 92 REVISED AS-CONSTRUCTED
13 JUL 89 NEW SHEET
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
S. BARTH
E. CLAVSON
L. RENNING
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
ACCESS ROAD – PLAN & PROFILE
STA. 17+00 TO STA. 34+00
SCALE: AS SHOWN
DWG. NO. 6352A
R-3
21A
ME-12-4-19
11 July 89
CHIEF, CIVIL PROJECTS SECTION 3
SCALE: 1=1
DATE: 19 JAN 89
CADFILE: CR-3
ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

FUNCTION ANALYSIS – VE PAYS

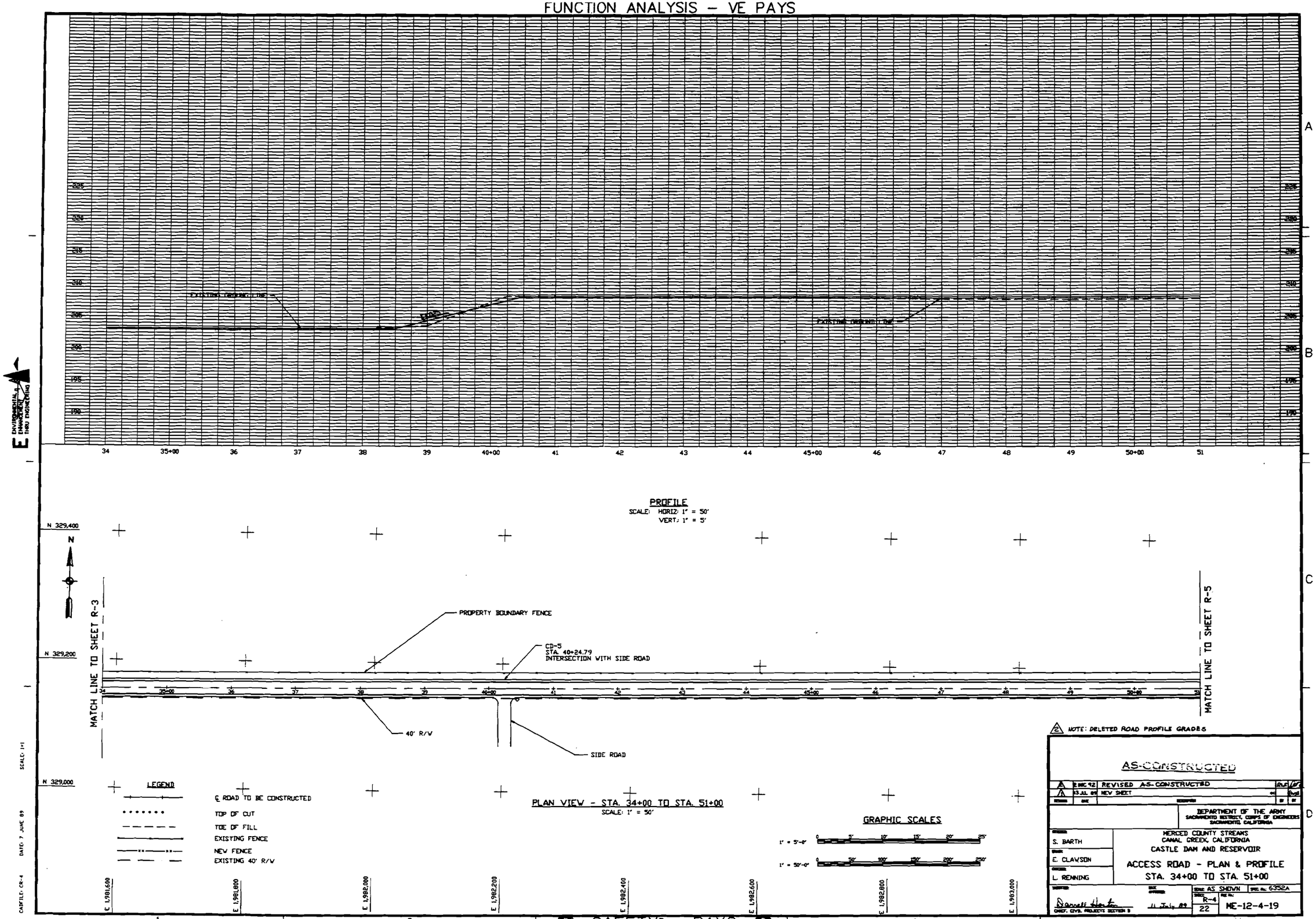
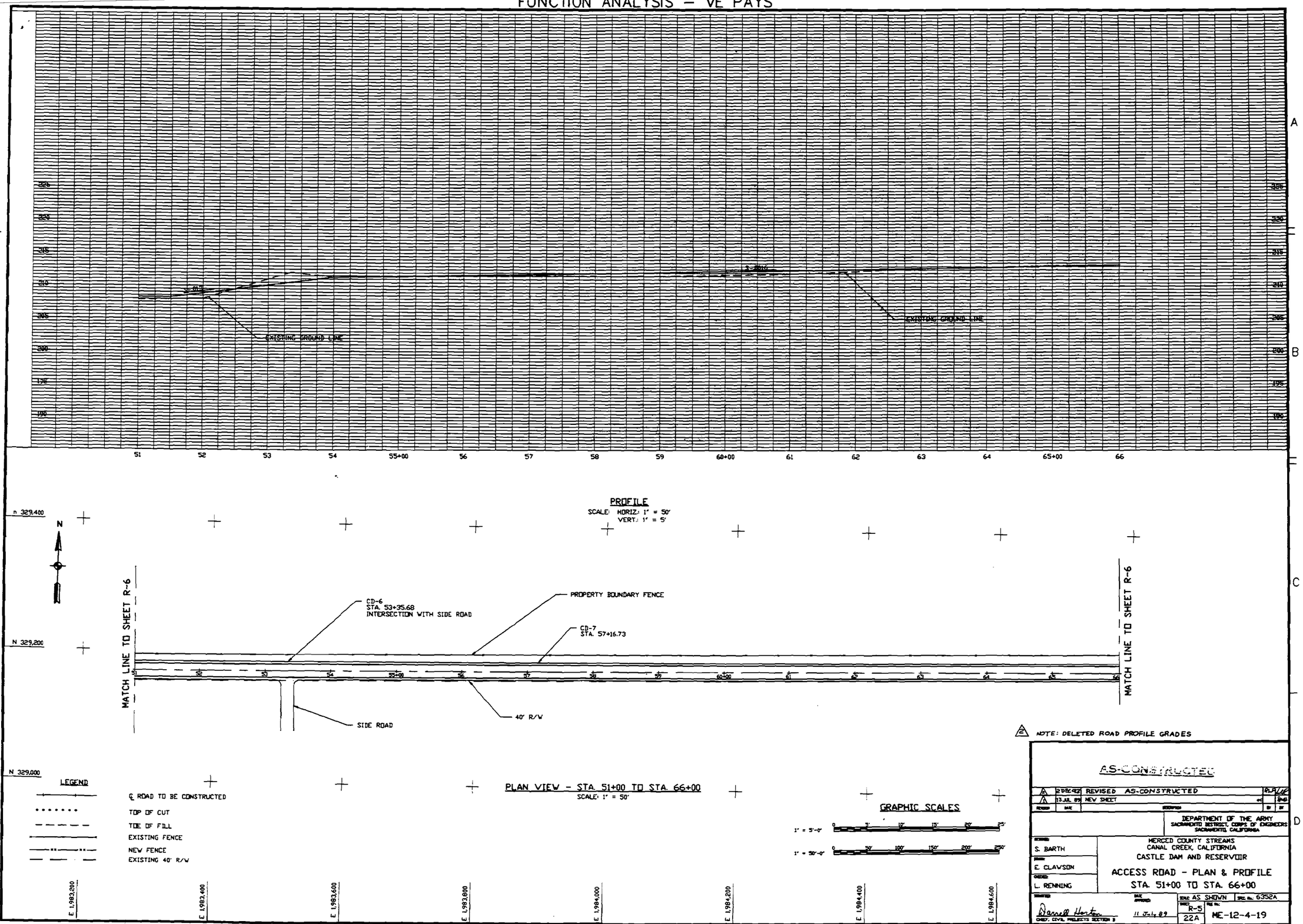


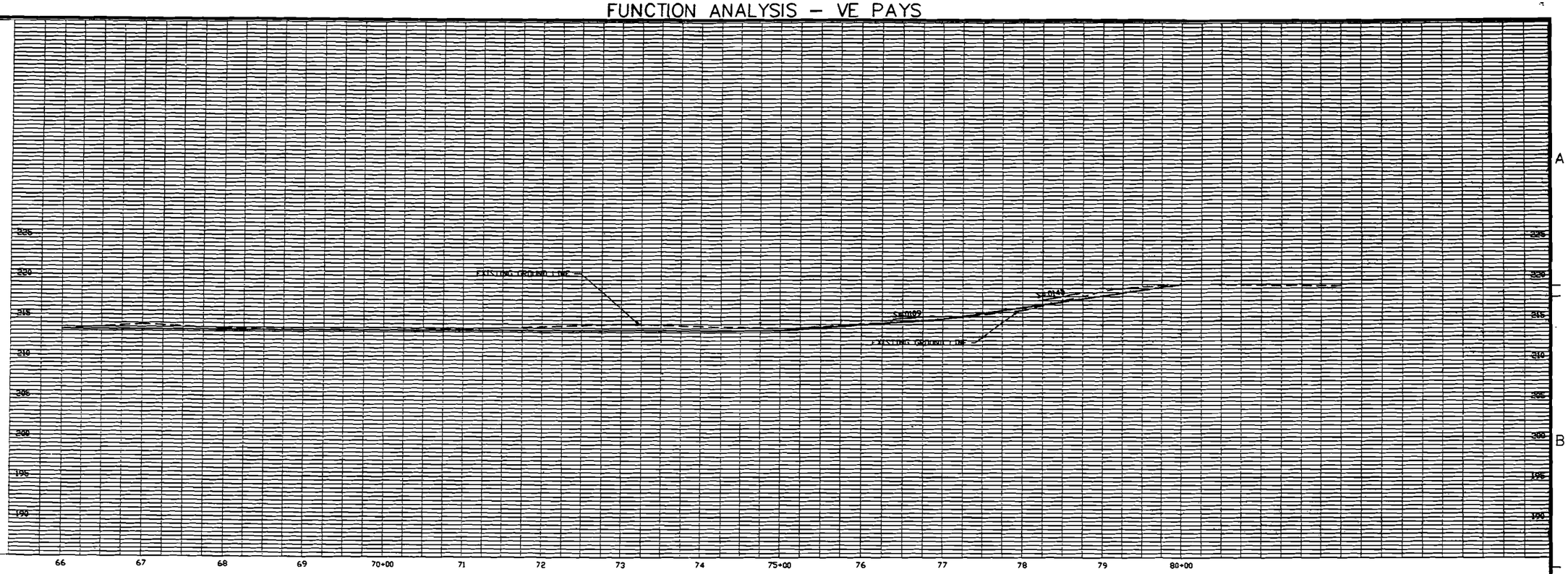
PLATE 24

FUNCTION ANALYSIS – VE PAYS

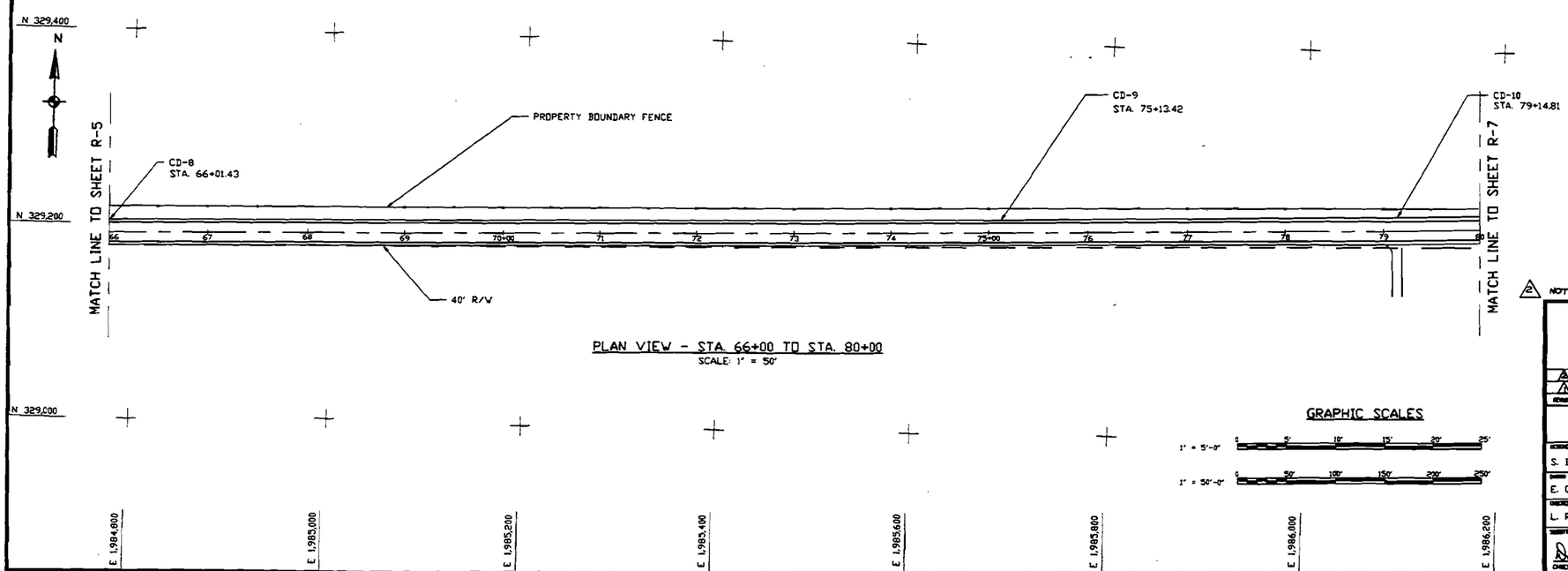


SAFETY3 PAYS

PLATE 25



PROFILE
SCALE: HORIZ.: 1" = 50'
VERT.: 1" = 5'



PLAN VIEW – STA. 66+00 TO STA. 80+00
SCALE: 1" = 50'

LEGEND

- ℄ ROAD TO BE CONSTRUCTED
- EXISTING FENCE
- NEW FENCE
- EXISTING 40' R/W

GRAPHIC SCALES

1" = 5'-0"

1" = 50'-0"

2 NOTE: DELETED ROAD PROFILE GRADES

AS-CONSTRUCTED

2	2 DEC 92	REVISED AS-CONSTRUCTED	
1	23 JUL 89	NEW SHEET	

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

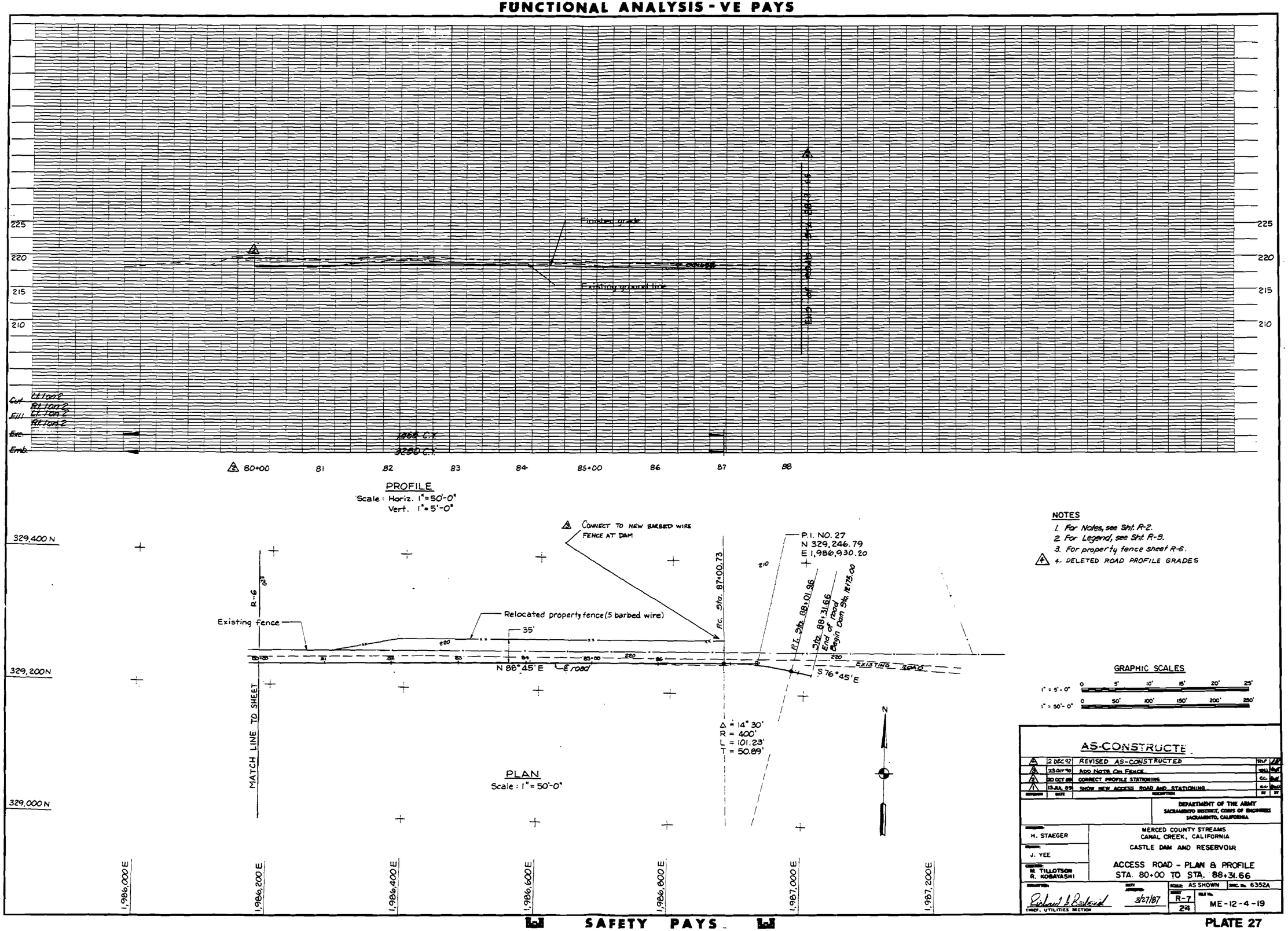
DESIGNED: S. BARTH
DRAWN: E. CLAVSON
CHECKED: L. RENNING

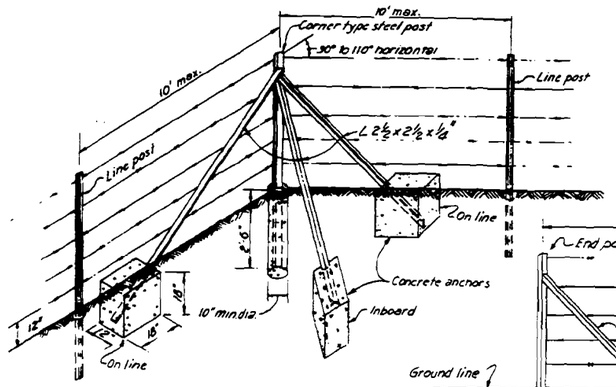
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

ACCESS ROAD – PLAN & PROFILE
STA. 66+00 TO STA. 80+00

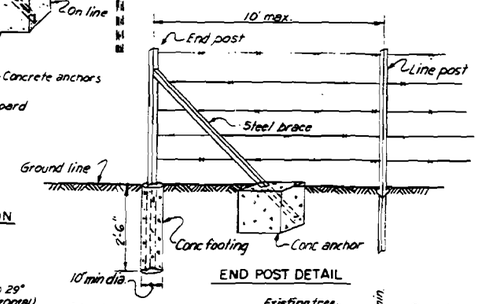
SUBMITTED: Donald Hunter, CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED: 11 July 89
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: R-6 / 23
FILE No.: ME-12-4-19

CADFILE: CR-6 DATE: 30 JUN 89 SCALE: 1=1

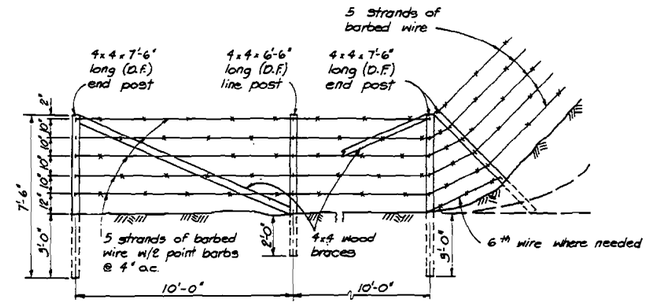

225
220
215
210
Finished grade
Existing ground line
END OF ROAD STA. 88+31.66
Cut
Lt 1001 2
Rt 1001 2
Fill
Lt 1001 2
Rt 1001 2
Exc.
Emb.
1468 C.Y.
3250 C.Y.
80+00
81
82
83
84
85+00
86
87
88
PROFILE
Scale: Horiz. 1"=50'-0"
Vert. 1"=5'-0"
CONNECT TO NEW BARBED WIRE FENCE AT DAM
P.I. NO. 27
N 329,246.79
E 1,986,930.20
329,400 N
329,200 N
329,000 N
R-6
Existing fence
Relocated property fence (5 barbed wire)
35'
P.C. Sta. 87+00.73
P.T. Sta. 88+01.96
Sta. 88+31.66
End of road
Begin Dam Sta. 18+75.00
N 88°45' E
℄ road
EXISTING ROAD
S 76°45' E
MATCH LINE TO SHEET
Δ = 14° 30'
R = 400'
L = 101.23'
T = 50.89'
PLAN
Scale: 1" = 50'-0"
N
1,986,000 E
1,986,200 E
1,986,400 E
1,986,600 E
1,986,800 E
1,987,000 E
1,987,200 E
NOTES
1. For Notes, see Sht. R-2.
2. For Legend, see Sht. R-9.
3. For property fence sheet R-6.
4. DELETED ROAD PROFILE GRADES
GRAPHIC SCALES
1" = 5'-0"
0 5' 10' 15' 20' 25'
1" = 50'-0"
0 50' 100' 150' 200' 250'
AS-CONSTRUCTE
2 DEC 92 REVISED AS-CONSTRUCTED
23 OCT 90 ADD NOTE ON FENCE
20 OCT 89 CORRECT PROFILE STATIONING
13 JUL 89 SHOW NEW ACCESS ROAD AND STATIONING
DATE DESCRIPTION BY
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
H. STAEGER
J. YEE
M. TILLOTSON
R. KOBAYASHI
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
ACCESS ROAD - PLAN & PROFILE
STA. 80+00 TO STA. 88+31.66
CHIEF, UTILITIES SECTION
3/27/87
AS SHOWN
6352A
R-7
24
ME-12-4-19

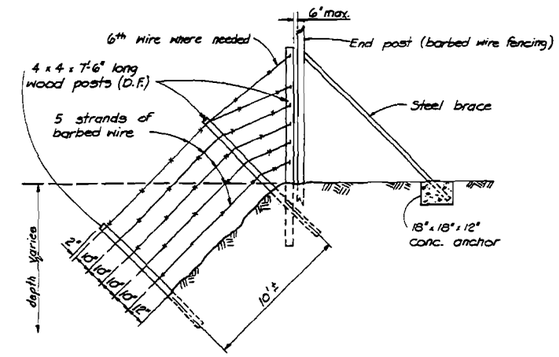


CORNER CONSTRUCTION FOR
30° TO 110° HORIZONTAL DEFLECTION
NOT TO SCALE

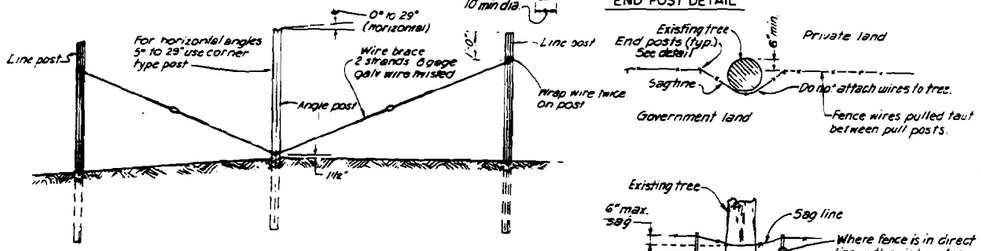


END POST DETAIL

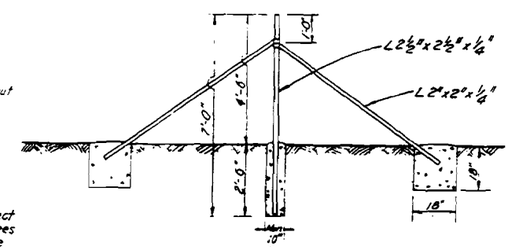




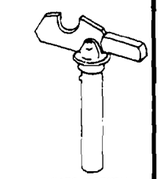
BREAKAWAY FENCING ACCROSS LARGE CREEKS AND GULLIES
NOT TO SCALE



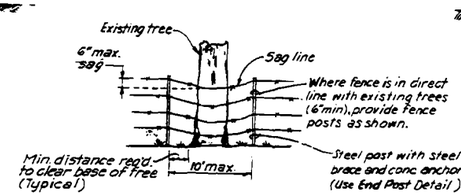
ALIGNMENT ANGLE CONSTRUCTION FOR
0° TO 29° HORIZONTAL DEFLECTION
NOT TO SCALE



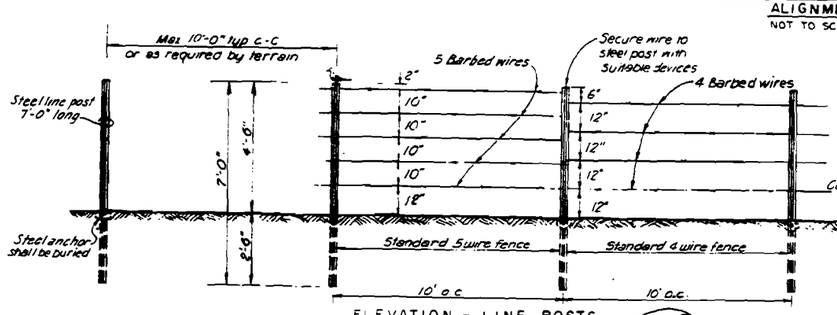
PULL POST ASSEMBLY
AT 500' MAX. INTERVALS
NOT TO SCALE



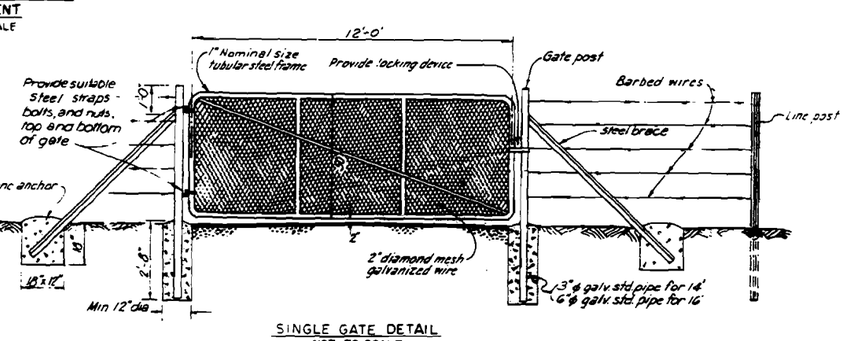
GATE KEEPER
(TO HOLD GATE OPEN)



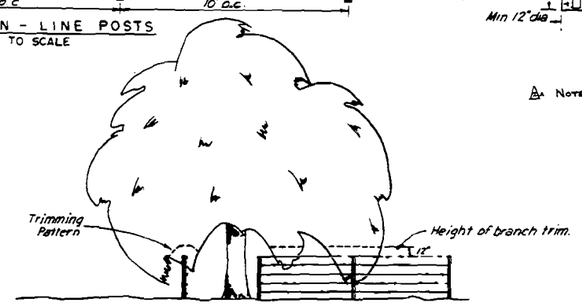
TREES ON PROPERTY FENCE
ALIGNMENT
NOT TO SCALE



ELEVATION - LINE POSTS
NOT TO SCALE



SINGLE GATE DETAIL
NOT TO SCALE



BRANCH TRIM OVER FENCE
NOT TO SCALE

NOTE: DETAIL IS FOR SINGLE GATE. DOUBLE GATES WOULD BE SAME DESIGN WITH A DROP BAR ASSEMBLY BETWEEN THE TWO GATES. THE DROP BAR ASSEMBLY WILL BE SECURED IN CONCRETE SIMILAR TO A GATE POST. THE DROP BAR ASSEMBLY WILL ALSO PROVIDE A LOCKING DEVICE.

GENERAL NOTES

1. All posts in swales or gullies must be firmly anchored
2. All wires must be tight and uniform
3. For type and quality of materials required see Specifications.
4. Construct fence on right-of-way line as shown on drawings.
5. Concrete for post footings and anchors shall be as indicated in the Specifications.
6. Do not place fence posts in gully or stream. If gully or stream is wider than 8ft, fence shall be constructed as directed by Contracting Officer.

AS CONSTRUCTED

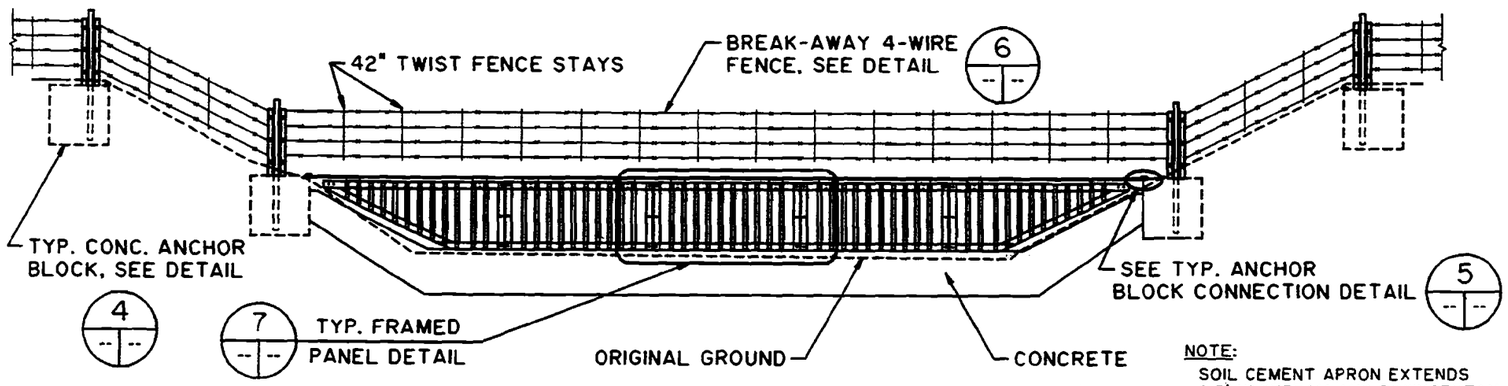
REVISION	DATE	DESCRIPTION	BY	BY
2 A	15 Jan 71	ADD NOTE ON DOUBLE GATE		
1	13 Feb 69	CHANGE SHEET NO. R-6 TO R-8		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: H. STAEGER
DRAWN: L. BRAZ
CHECKED: M TILLOTSON, R. KOYBAYASHI

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
PROPERTY FENCE,
FENCE AND GATE DETAILS

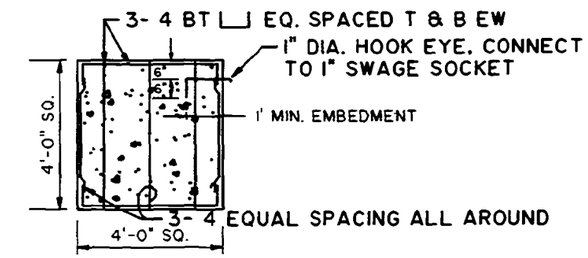
SUBMITTED: Richard B. Bonbrook, CHIEF, UTILITIES SECTION
DATE APPROVED: 3/27/67
SCALE: AS SHOWN
SPEC. NO. 6352A
SHEET R-8 OF 25
FILE NO. ME-12-4-19



SECTIONAL ELEVATION WATER GAP DETAIL 1

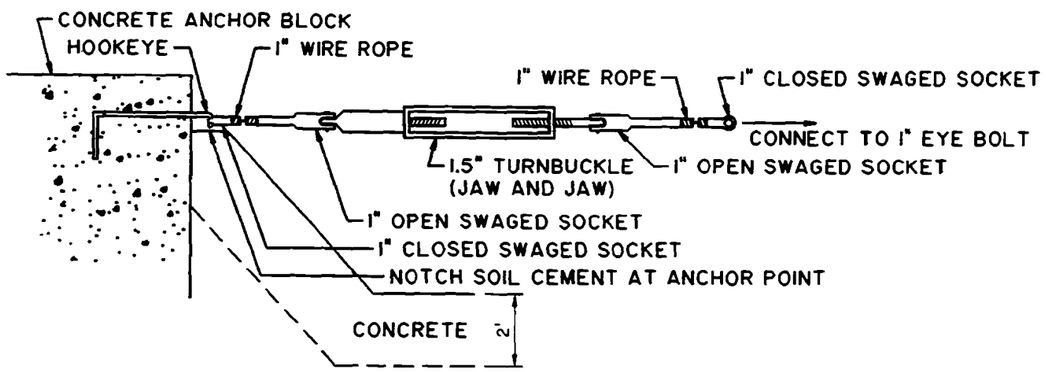
NOT TO SCALE

NOTE:
SOIL CEMENT APRON EXTENDS 2.5' UPSTREAM AND DOWNSTREAM FROM ℄ OF WATER GAP.



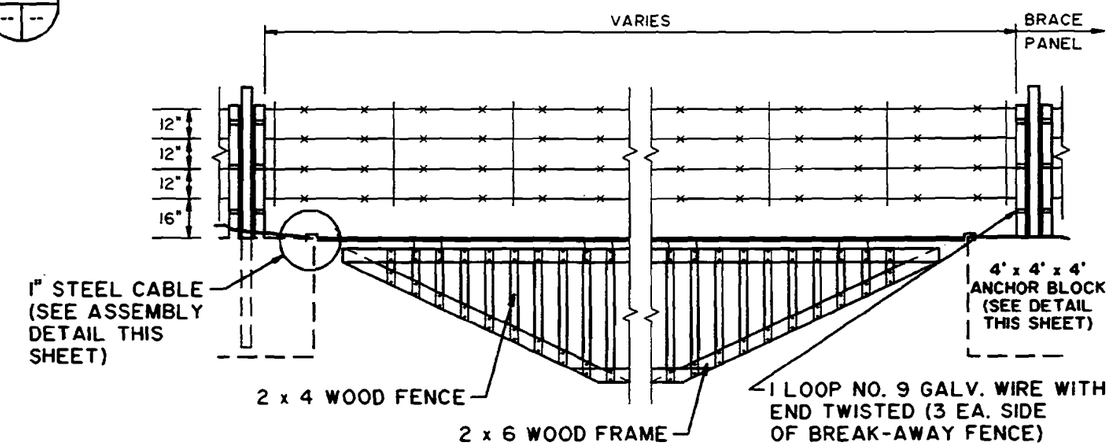
TYPICAL ANCHOR BLOCK DETAIL 4

NOT TO SCALE



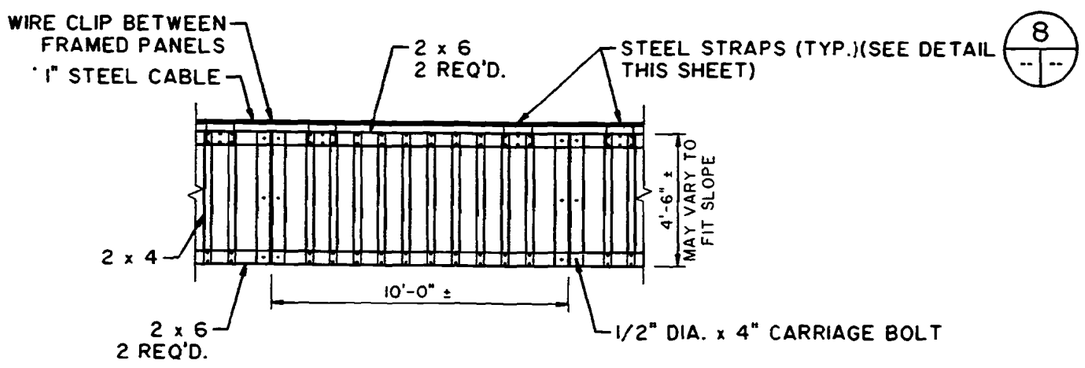
ANCHOR BLOCK CONNECTION DETAIL 5

NOT TO SCALE



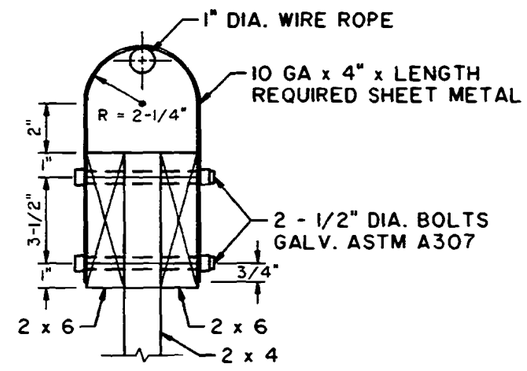
BREAK-AWAY FENCE DETAIL 6

NOT TO SCALE



TYPICAL FRAMED PANEL 7

NOT TO SCALE



TYPICAL STEEL STRAP 8

NOT TO SCALE

NOTES:

1. AFTER INSTALLING THE FRAMED PANELS, ADJUST THE TURNBUCKLES TO ALLOW FOR A 2" MIN., 3' MAX. SAG IN THE 1" DIA. WIRE ROPE.
2. THE 1" WIRE ROPE SHALL BE GALVANIZED 6 x 19 IWRC.
3. ENSURE TURNBUCKLE AND WIRE ROPE ARE OF THE APPROPRIATE SIZE. SEE DETAIL 5.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

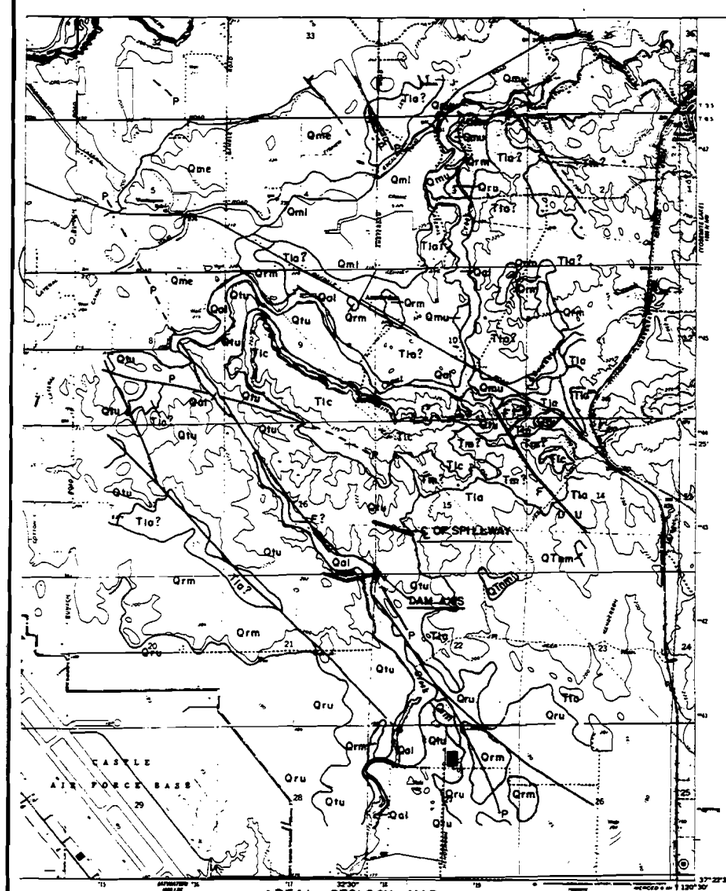
MERCED COUNTY STREAMS, CALIFORNIA

CASTLE DAM

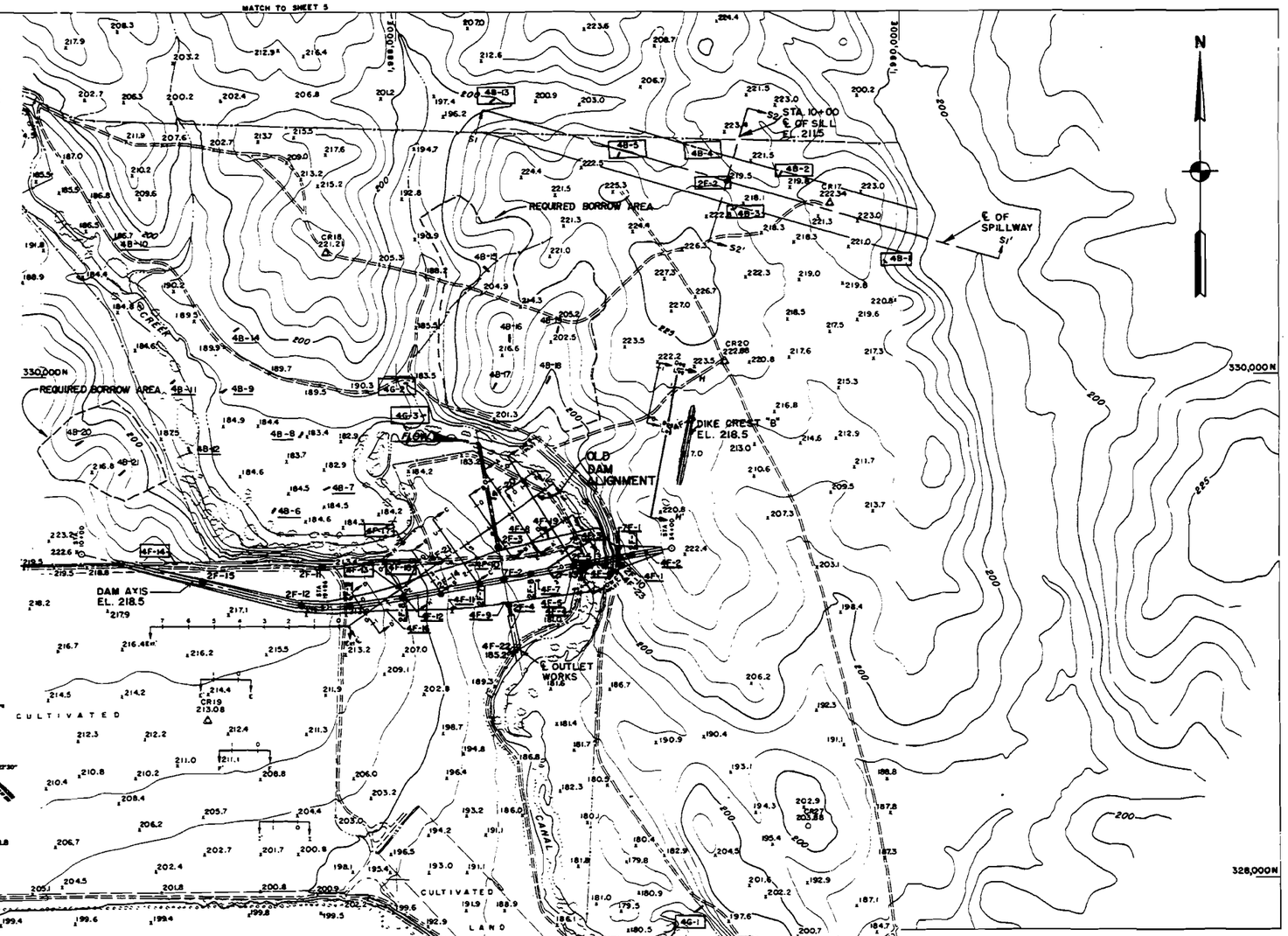
WATER GAP

DATE:	SCALE:	
26 FEB 96	NONE	PLATE 28A

WATERGAP.DWG PLOT 1=1 NLB 02-26-96



AREAL GEOLOGY MAP



EXPLORATION MAP

EXPLANATION

Holocene

Pleistocene

Qal — Alluvium: alluvial sand, silt, and gravel associated with floodplains and low terraces.

Modesto formation

Upper member — Qmu — Coarse alluvium: alluvial sand, silt, and gravel of channels, terraces, and upper fans.

Lower member — Qml — Coarse alluvium: alluvial sand, silt, and gravel of channels, terraces, and upper fans.

Qme — Eolian sand: moderately well sorted.

Riverbank formation

Upper unit — Qru — Alluvium: alluvial sand, silt, and gravel.

Middle unit — Qrm — Alluvium: alluvial sand, silt, and gravel.

Turlock Lake formation

Upper unit — Qtu — Arkosic alluvium: alluvial granitic sand and minor gravel overlying stratified fine sand, silt, and minor clay.

Pliocene or Pleistocene

North Merced Gravel

QTmg — Log gravel deposits: thin, locally derived sediment veneer of cobble gravel capping Tertiary and pre-Tertiary rocks near foothills of the Sierra Nevada.

Tertiary or Quaternary

Laguna formation

Tlc — China Hat Gravel Member of upper unit, thick cobble gravel with a granitic matrix and interbedded granitic sand and minor silt; uppermost member of Laguna formation, exposed through topographic inversion of an old alluvial distributary system south of the Merced River.

Tla — Arkosic alluvium: granitic sand, silt, and minor gravel underlying the China Hat Gravel Member; includes both upper and lower units; contains some reworked andesitic detritus near base; weakly to moderately indurated.

Tertiary

Mariposa formation

Tm — Andesitic fluvial deposits: sand, silt, and minor gravel, presumably reworked from volcanic mudflow deposits to the northwest; moderately indurated.

Contact

Fault: D indicates downthrown side and U indicates upthrown side.

Photolineament: dashed where inferred.

NOTE:

1. The Areal Geologic Map was taken from USGS Open-file Report 76-836 (preliminary-released December 1976) by Donia E. Marchand, and the explanation was taken from USGS Map MF-995 (1978) by Donia E. Marchand and Alan Allwardt. They were slightly modified for use in this report.

NOTES:

1. Refer to Sheet C-20 for spillway sections.
2. Refer to Sheet C-17 for dam section, B-B' through G-G'.
3. All elevations are in feet.
4. Holes were drilled with a 24-inch-diameter bucket auger.
5. Refer to Sheets C-4 to C-11 for drill hole logs.
6. Refer to Sheets C-12 to C-16 for trench logs.
7. Refer to Sheet C-10 for drill logs at dike A and location map.

EXPLANATION OF SYMBOLS

S1 — Line of geologic sections.

2F-7 — Auger hole locations.

4G-3, 4F-25 — Exploration trench locations.

E E' — Seismic survey locations. Sections on Sheet C-3

7F-1 — Undisturbed Pitcher tube hole 6 inch dia.

4G-1 — Trenches for geologic investigation of lineaments.

NOTE: These seismic lines were done for the original dam & spillway alignments in July 1978.

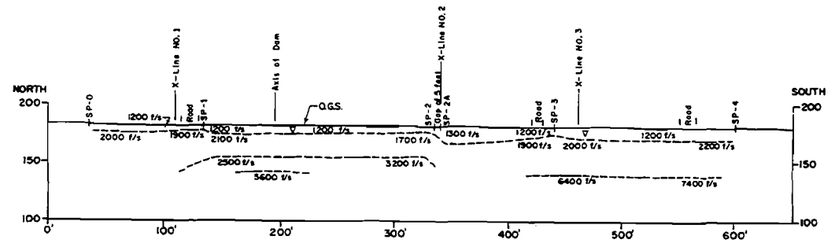
AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

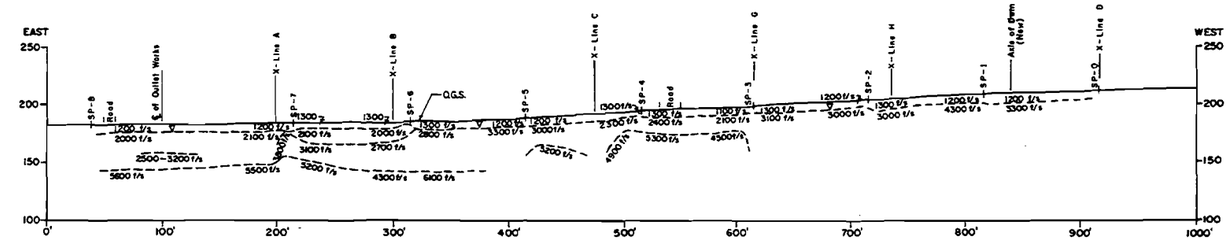
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
AREAL GEOLOGY AND EXPLORATIONS

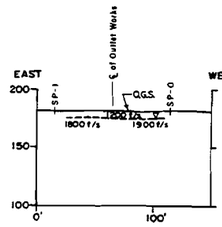
DESIGNED: R.L. TREAT
DRAWN: D.W. PAIGE
CHECKED: J.B. MOSES
SUBMITTED: Robert L. Treat, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 Mar 87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: CG-1 / 26
FILE No. ME-12-4-19



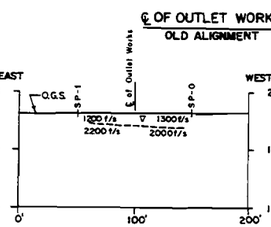
℄ OF OUTLET WORKS
OLD ALIGNMENT



RIGHT ABUTMENT ℄



CROSS LINE NO.1



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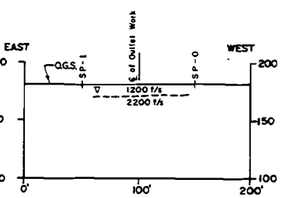
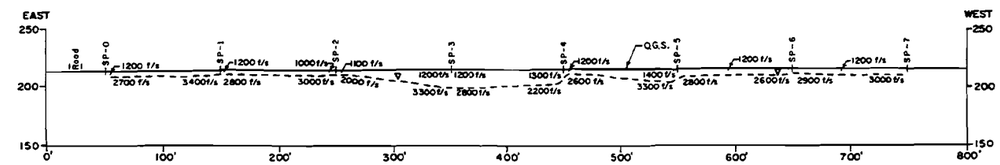
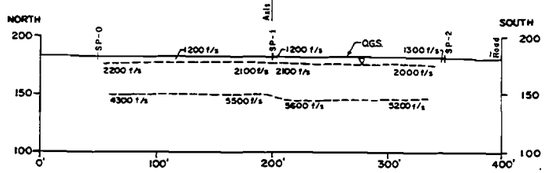


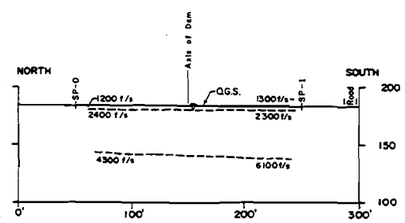
CROSS LINE NO.3



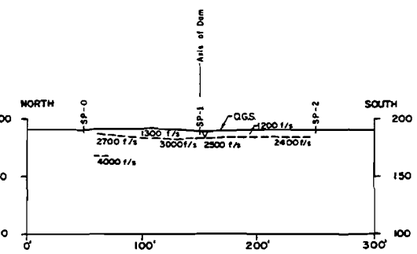
EXTENSION ON RIGHT ABUTMENT



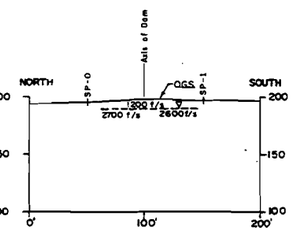
CROSS LINE A



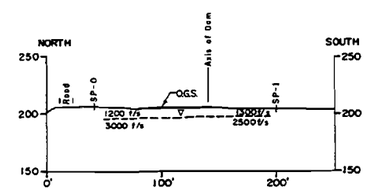
CROSS LINE B



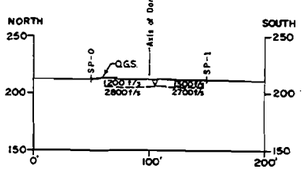
CROSS LINE C



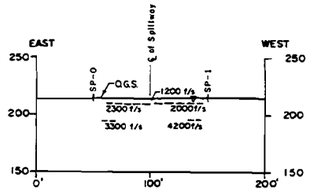
CROSS LINE G



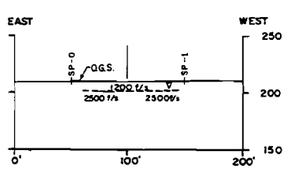
CROSS LINE H



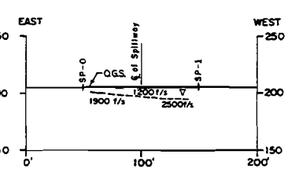
CROSS LINE D



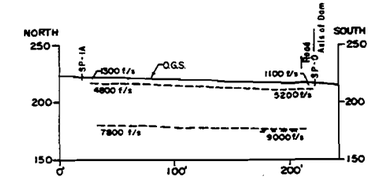
SPILLWAY CROSS LINE E



CROSS LINE F



CROSS LINE I



LEFT ABUTMENT DOG LEG

EXPLANATION OF SYMBOLS

Soil: Velocity range 800 feet per second to 2,000 f/s.

Weathered: Velocity range 2,000 f/s to 7,900 f/s.

Unrippable: Velocity range 7,900 to 15,000 f/s.

Geologic-Seismic Boundary.

O.G.S. Original Ground Surface.

▽ Soil Layer.

NOTES:

Refer to Areal Geology and Explorations Sheet for Locations, Sheet C6-1

All Elevations are in feet

Elevations refer to sea level datum of 1929.

These seismic lines were done for the original dam & spillway alignments in July 1978.

See Sheet C6-1 for location of Sections.

GRAPHIC SCALE

1 inch = 50 Feet

50' 25' 0' 50' 100' 150' 200'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: J.J. Gewerth, D.W. Paige
DRAWN: D.W. Paige
CHECKED: J.J. Gewerth, D.W. Paige, R.L. Trost
SUBMITTED: Robert L. Trost, CHIEF, GEOLOGY SECTION

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
GEOLOGIC – SEISMIC SECTIONS
(ON OLD DAM ALIGNMENT)

DATE APPROVED: 27 May 87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: C6-2 / 27
FILE No. ME-12-4-19

2F-1 (ELEV. 211.3)

Depth	Class.	N	GR	SA	FI	LL	PI	MC	Description
0 – 1.0'	SC	17	—	—	—	—	—	—	CLAYEY SAND, brown, damp, firm, 60% very fine sand, 40% low plastic fines, abundant grass roots in top 0.3'. (F)
1.0' – 2.6'	CL		—	—	—	—	—	—	SANDY CLAY, light brown, dry, stiff, 40% very fine sand, low plastic fines. (F)
2.6' – 4.7'	ML	31, R	—	59	41	46	12	—	SILT, light brownish gray, damp, firm to very dense, sizes larger than No. 200 sieve are cemented silt particles.
4.7' – 9.0'	MH	R, 38	—	—	—	—	—	—	*SILT, grayish brown, moist, firm to very firm, fine to medium sand, 95% nonplastic fines.
9.0' – 10.0'		R	—	—	—	—	—	—	9.0', as above, tan and gray mottled. (F)
10.0' – 13.0'	CL	R	—	15	85	35	13	—	SANDY CLAY, light brown with iron oxide stains, damp, very stiff to hard.
13.0' – 15.3'	SM	R, 18	—	—	—	—	—	—	SILTY SAND, light brown, damp, firm to very dense, 60% very fine sand. (F)
15.3' – 20.0'	CL	52, 63	—	—	—	—	—	—	SANDY CLAY, tan and gray mottled, moist, stiff to hard, 25% very fine sand, low plasticity. (F)
20.0' – 22.0'	ML	50	—	28	72	37	11	—	SANDY SILT, light brownish gray, moist, very firm, fine sand.
22.0' – 24.0'	SM	52	—	—	—	—	—	—	SILTY SAND, light brown, damp, very firm to firm, 85% very fine to fine sand. (F)
24.0' – 26.0'		85	—	—	—	—	—	—	SILT, greenish gray with iron oxide stains, damp, hard. (F)
26.0' – 29.5'	ML	33, 46	—	2	98	43	15	—	26.0', as above, moist, firm to very firm, trace of very fine sand.
29.5' – 34.5'		37, 45	—	—	—	—	—	—	29.5', as above, abundant iron oxide stains. (F)
34.5' – 40.0'	CL	30, 22, 36	—	—	—	—	—	—	*SANDY CLAY, yellowish brown, moist, stiff to very stiff.

Drilled 11-12 December 1978

2F-2 (ELEV. 219.5)
℄ SPILLWAY SILL

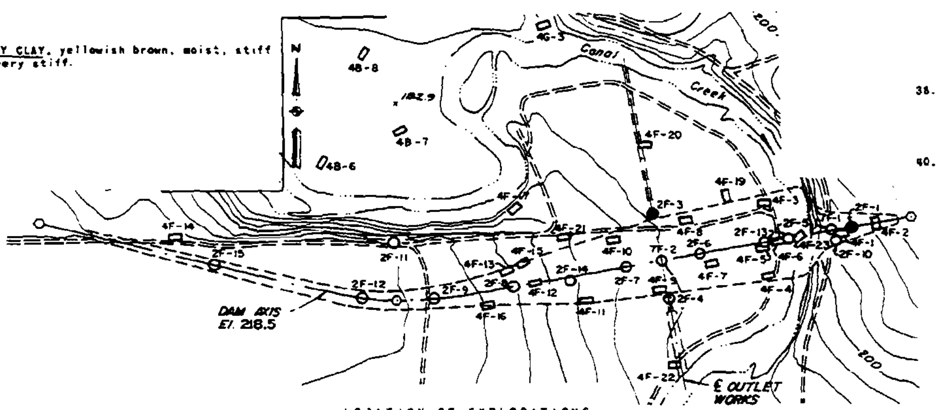
Depth	Class.	N	GR	SA	FI	LL	PI	MC	Description
0 – 0.7'	ML		—	—	—	—	—	—	*SANDY SILT, dark brown, moist, very loose, 60% fines, 40% fine to medium sand, rare well-rounded gravel to 5/8" maximum diameter, grass roots in top 0.3'
0.7' – 1.1'	CL		—	—	—	—	—	—	SANDY CLAY, dark reddish brown, damp, soft, 15% very fine sand, micaceous. (F)
1.1' – 4.5'	SC	10, 46, R	—	—	—	—	—	—	CLAYEY SAND, light brown to yellowish brown, iron oxide stained, damp, soft to very stiff, 10%-15% clay, very fine to fine micaceous sand, low plastic fines. (F)
4.5' – 6.2'	ML		—	3	97	33	9	185	CLAYEY SILT, light gray to tan, some iron oxide stains, damp, stiff to hard, very fine sand, micaceous, low to medium plasticity.
6.2' – 8.5'	SM	43	—	—	—	—	—	—	SILTY SAND, light grayish brown, damp, very firm, 60% very fine to fine sand, 35% silt, micaceous. (F)
8.5' – 9.5'	ML	69	—	20	80	32	5	—	SANDY SILT, light brownish gray, damp, very firm to dense, very fine to fine sand.
9.5' – 12.0'	SW-SM	67	—	—	—	—	—	—	SAND, light brownish gray, damp, dense, very fine to fine grained, micaceous, lenses of clayey sand, firm to dense. (F)
12.0' – 13.5'	CL	65	—	7	93	37	15	—	CLAY, grayish brown, moist, very stiff to hard, sand very fine to fine grained.
13.5' – 16.5'	SM	35	—	—	—	—	—	—	SILTY SAND, tan with iron oxide stains, damp, firm, very fine to fine sand 15% fines. (F)
16.5' – 19.5'	ML	42, 37	—	16	84	39	13	—	SILT, olive to tan, iron oxide stains, moist, firm to very dense, sand very fine to fine grained, micaceous.
19.5' – 21.0'	SC	31	—	—	—	—	—	—	CLAYEY SAND, light tan, iron oxide stains, damp, stiff, very fine to fine sand, 30% clay, low plastic fines. (F)
21.0' – 22.5'	SM		—	—	—	—	—	—	*SILTY SAND, light tan, damp, stiff, very fine to medium sand, 22% fines.
22.5' – 25.0'	ML	R	—	—	—	—	—	—	*SANDY SILT, light grayish tan, damp, very firm to dense, slightly cemented in part, very fine to medium sand, abundant grains of white pumiceous material, 48% - 55% low plastic fines.
25.0' – 25.5'		59	—	—	—	—	—	—	*SANDY SILT, gray brown, moist, dense, very fine to medium sand, 55% low plastic fines.

Drilled 12-13 December 1978

2F-3 (ELEV. 184.0)

Depth	Class.	N	GR	SA	FI	LL	PI	MC	Description
0 – 1.7'	SW-SM	4	—	—	—	—	—	—	SAND, dark brown, damp, very loose, fine to medium sand, trace of silt, scattered well-rounded gravel to 5/8" maximum diameter. (F)
1.7' – 6.0'	SM	22, 36	—	—	—	—	—	—	*SILTY SAND, light reddish tan to brown, damp, loose to very firm, very fine to medium sand, thin clay layers, scattered well rounded gravel to 1" diameter, 27% low plastic fines. 5.6', layer of coarse well rounded gravel and small cobbles to 6" maximum diameter.
6.0' – 6.3'		R	—	24	74	37	19	16	SANDY CLAY, brownish gray, damp, hard, medium plasticity.
6.3' – 8.2'	CL		—	—	—	—	—	—	As above mottled gray to reddish brown, trace of iron oxide stains, 40%-50% fine sand, medium plastic fines. (F)
8.2' – 10.0'	SC	48	—	54	46	31	16	21	CLAYEY SAND, light brownish gray, trace of iron oxide stains, damp, very stiff, fine sand
10.0' – 11.3'		28	—	—	—	—	—	—	SILTY SAND, brownish gray, some iron stains, damp, stiff, very fine to fine sand. (F)
11.3' – 16.0'		23, 21	—	81	19	—	—	—	**SILTY SAND, brown, moist, stiff, very fine to fine sand, slightly micaceous, low plastic fines.
16.0' – 20.0'	SM	25, 36	—	—	—	—	—	—	16.0', trace of clay. 17.5', 0.5' layer of clayey sand. 19.5', thin layer of clayey sand.
20.0' – 24.0'		34, 27	—	83	17	—	—	—	20.0', as above, damp to moist, sand slightly coarser, traces of clay. 23.0', mottled with streaks of gray silty sand, some yellow-brown iron staining.
24.0' – 28.0'		35, 23	—	—	—	—	—	—	24.5', sand coarser to 26.0' with scattered small gravel, very small percent fines. (F) 26.0', sand as above 24.5', mostly fine to medium.
28.0' – 29.6'		20	—	85	15	—	—	—	28.0', as above.
29.6' – 30.5'	SC		—	56	44	38	21	43	CLAYEY SAND, light brownish gray, mottled with iron oxide stains, moist, stiff, very fine to fine sand, rare well rounded gravel to 3/8" maximum diameter.
30.5' – 34.0'		44, 51	—	—	—	—	—	—	*SILTY SAND, light grayish brown, mottled with light yellowish brown iron oxide stains, moist, firm to very firm, 90% graded sand, rare well rounded gravel to 3/8" diameter, micaceous, low plastic fines.
34.0' – 38.0'	SP-SM	47, 52	—	—	—	—	—	—	35.0', 0.5' light gray sand. (F) 37.3', 0.2' as at 35.0'.
38.0' – 40.0'		77	—			—	—	—	38.0', as above, light olive brown.

Drilled 13-14 December 1978



LOCATION OF EXPLORATIONS

1 inch = 200 Feet 0' 200' 400' 600' 800' 1000'

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4 sieve.	Clean with sands	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing the No. 4 sieve.	Clean with sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands, or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid limit 50 and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 60%.

(SW) Indicates symbol based on field classification.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1 3/8-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- F Visual Field Classification.
- R Refusal with Standard Penetrometer.
- * Laboratory Visual Classification.
- MC Field Moisture Content in Percent of Dry Weight.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- N Number of Blows of Standard Penetrometer.
- ELEV. Elevations scaled from topographic map
- ** Classification based on laboratory gradation and visual field description.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (MIL-STD-619B).
2. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
3. All sieve sizes on this chart are U.S. Standard.
4. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (MIL-STD-619B) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
5. Drill hole 2F-2 located at spillway. See Sheet CG-1

GRAPHIC SCALE

1 inch = 2 Feet 0' 1' 2' 4' 6' 8' 10'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DRAWN BY: T.J.S., R.L.T., C.A.R.
CHECKED BY: J. B. Moses, R. L. Treat
PREPARED BY: R. L. Treat

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF FOUNDATION DRILL HOLES
2F-1 THRU 2F-3

SUBMITTED: Robert L. Treat, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 Mar 87
SCALE: AS SHOWN
SPEC. No. 6352
SHEET CG-3 / 28
FILE No. ME-12-4-19

2 F - 4 (ELEV. 186.0)

Depth		N	GR	SA	FI	LL	PI	MC	
0									
0.9'		7							SILTY SAND, dark brown, damp, loose, fine sand, small percent low plastic fines. (F)
1.5'									1.5', as above, dark brown, moist, firm. 55% fine to medium sand, micaceous, low plastic fines.
3.0'	SM	24							
		18							3.0', light brownish tan, damp, smaller percent fines, scattered white pumiceous grains.
6.8'		47							
	ML			40	60	24	1		SANDY SILT, pale brown, mottled with iron oxide stains, moist, firm to very firm, fine sand, micaceous, scattered white pumiceous grains.
8.5'		35							** SILTY SAND, brown, mottled with iron oxide stains, moist, firm, scattered rounded gravel to 3/8" maximum diameter, fine sand, micaceous, low plastic fines.
	SP-SM			88	12				
10.4'		39							
				44	56	37	18	16	SANDY CLAY, brown, mottled with iron oxide stains, damp, stiff to very stiff, very fine to medium sand, micaceous.
12.2'	CL								
		40		42	58	36	21	14	As above, grayish brown, damp, stiff to very stiff, very fine to medium sand, micaceous, abundant white pumiceous grains.
13.8'									
		33							
									SILTY SAND, light brownish gray, damp, firm to very firm, fine to coarse sand, micaceous, small percent fines, abundant white pumice grains. (F)
		40							
18.0'	SM								
		29							*18.0', as above, brown, moist, firm. 85% graded sand, low plastic fines.
		26							21.5', moist with a trace of clay.
22.5'	SP-SM	31							SAND, light grayish brown, damp, firm, very fine to coarse sand, micaceous, scattered subrounded to well rounded gravel to 3/8" maximum diameter, small percent fines. (F)
24.2'		37							** SILTY SAND, yellowish brown, moist, loose to very firm, fine to coarse sand, micaceous, low plastic fines.
				85	15				
	SM	24							26.0', slightly coarser sand.
28.0'									
		25		92	8				28.5', sand is cleaner.
30.5'		16							SAND, light grayish brown, damp, loose to firm, fine to coarse grained, micaceous, scattered gravel to 3/8" maximum diameter, small percent fines.
		22							32.0', 0.5' clayey layer.
	SP-SM	21							34.5', rare dark brown stained, rounded gravel size fragments of claystone to 1/2" maximum diameter.
									35.0', 0.6' sand, brown, fine grained, small percent fines. (F)
		19							
38.8'		13							
40.0'	SM		2	91	7				** SILTY SAND, brown, damp, loose, fine to coarse grained, micaceous, scattered well rounded gravel to 2" maximum diameter.

Drilled 14 December 1978

2 F - 5 (ELEV. 181.8)

Depth		N	GR	SA	FI	LL	PI	MC	
0									
0.9'	SC	2							CLAYEY SAND, dark brown, damp, very soft, very fine to fine sand, micaceous, 10% clay, top 0.8' has grass roots. (F)
1.6'									*As above, moist, 65% fine to medium sand, low plastic fines.
		12		69	31	18	2		SILTY SAND, light reddish brown to tan, damp, micaceous, scattered well rounded gravel to 3/4" maximum diameter.
3.5'	SM								
		4							Same as above, less fines. (F)
6.1'	SC			84	16				** CLAYEY SAND, reddish brown, moist, firm, fine to coarse sand, low plastic fines.
6.8'		33							
				50	50	29	5	23	SANDY SILT, yellowish brown, mottled with iron stains, damp, stiff, very fine grained sand, micaceous, low plastic fines.
	ML	22							
9.5'									
		26							9.5', as above, light brownish gray, less iron oxide stains, moist, firm to very stiff, sand content increases downward. (F)
11.5'									
	SM	25							SILTY SAND, light brownish gray with abundant iron oxide stains, damp, loose to firm, very fine sand, micaceous, 20% low plastic fines. (F)
									14.0', 0.5' layer of clean sand.
15.0'		22							SANDY CLAY, light reddish tan and gray, damp, stiff, very fine grained sand, micaceous, medium plastic fines.
15.5'	CL			48	52				
									*SILTY SAND, yellowish brown iron oxide stained, moist, stiff, 65% fine to medium sand, low plastic fines.
		27							
17.5'	SM								
		23		86	14				17.5', as above, light grayish brown, with iron oxide stains, damp, firm to stiff, very fine to fine sand, micaceous. low plastic fines. (F)
21.0'		21							
									SANDY SILT, light grayish brown, mottled with iron oxide stains, damp, stiff, 40% very fine sand, micaceous, thin layers of sandy clay, low plastic fines.
23.0'	CL	19							
				19	81	39	18	31	SANDY CLAY, yellowish brown, moist, stiff, fine sand, micaceous.
24.7'									
25.5'		25							*24.7', as above, grayish brown, moist, stiff, fine sand, micaceous, 65% medium plastic fines.

Drilled 14-15 December 1978

2 F - 6 (ELEV. 182.9)

Depth		N	GR	SA	FI	LL	PI	MC	
0									
									CLAYEY SAND, dark brown, damp, soft, very fine to fine sand, micaceous, 45% low plastic fines, top 0.5' has grass roots. (F)
1.2'	SC	5							
				56	44	25	13		CLAYEY SAND, brown to light brownish tan, damp, soft to firm, very fine to coarse sand, scattered coarse sand, micaceous, 44% medium plastic fines.
3.0'		15							
	CL	18							*SANDY CLAY, yellowish brown, moist, firm to stiff, fine to medium sand, 55% medium plastic fines
6.4'									
6.6'	SC			7	73	20			CLAYEY SAND, reddish brown, moist, stiff, fine to coarse sand, scattered gravels to 3" maximum diameter, rare small cobbles, low plastic fines.
		35							
				42	58	35	14	20	SANDY CLAY, yellowish brown, damp, firm to stiff, fine sand, micaceous, mottled with iron oxide stains, medium plastic fines.
	CL	17							
10.0'									
		22							10.0', as above, light brownish tan. (F)
11.6'									
									SILTY SAND, light brown to brownish tan, damp, stiff, fine to medium sand, micaceous.
		20							
	SM								14.0', material has less fines.
				71	29	26	2		
		24							15.5', slightly coarser layers.
16.8'									
17.2'	SC	19		54	46	28	11		CLAYEY SAND, light brown and gray, damp, firm to stiff, fine sand.
									** SILTY SAND, yellowish brown, moist, loose to very firm, fine to medium sand with scattered coarse grains, nonplastic fines.
		37		94	6				
21.0'									21.0', light brownish gray, sand mostly fine.
	SP-SM	20							21.7', light brown, loose to firm. (F)
22.8'									** 22.8', same as at 17.2', loose to firm.
		13		93	7				
23.8'									23.8', same as at 21.7' (F)
24.6'									24.6', same as at 22.8', fine to medium sand.
		16		92	8				
25.5'									

Drilled 16 December 1978

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 65% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4 sieve.	Gravels Clean (little or no fines)		GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines (appreciable amount of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passes the No. 4 sieve.	Sands Clean (little or no fines)		SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines (appreciable amount of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 65% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50		ML	Inorganic silts and very fine sands, rock flour, silty fine sands, or silts. Plasticity below "A" line.
				CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
				OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50 and above		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
				CH	Inorganic fat clays. Plasticity above "A" line.
				OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils				Pt	Peat, organic content greater than 80%.

(SW) indicates symbol based on field classification

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Stiff
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

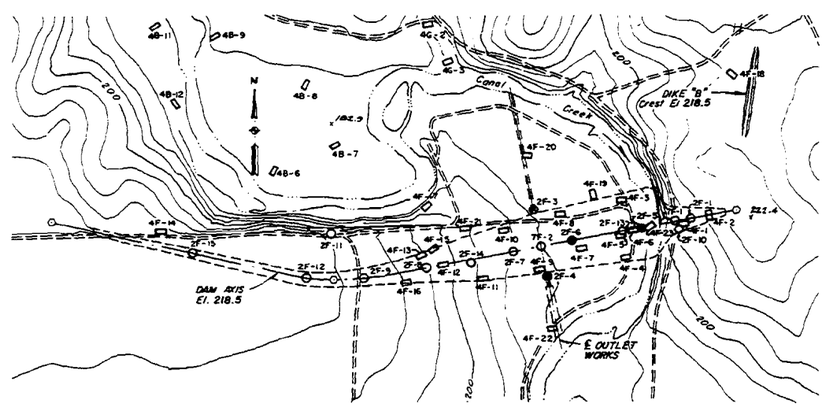
*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1 3/8-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- F Visual Field Classification.
- R Refusal with Standard Penetrometer.
- * Laboratory Visual Classification.
- MC Field Moisture Content in Percent of Dry Weight.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- N Number of Blows of Standard Penetrometer.
- ELEV. Elevations scaled from topographic map
- ** Classification based on laboratory gradation and visual field description.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (MIL-STD-619B).
2. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
3. All sieve sizes on this chart are U.S. Standard.
4. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (MIL-STD-619B) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.



LOCATION OF EXPLORATIONS

GRAPHIC SCALE

1 inch = 200 Feet (0' 200' 400' 600' 800' 1000')

GRAPHIC SCALE

1 inch = 2 Feet (0' 1' 2' 4' 6' 8' 10')

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DRAWN BY: T.J.S., R.L.T., J.A.R.
CHECKED BY: J.B. Moses, R.L. Treat
PREPARED BY: R.L. Treat
SUBMITTED: Robert L. Treat, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 Mar 87

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF FOUNDATION DRILL HOLES
2F-4 THRU 2F-6

SCALE: AS SHOWN | SPEC. No. 6352 A | SHEET CG-4 29 | FILE No. ME-12-4-19

2 F - 7 (ELEV. 189.8)

Depth	N	GR	SA	FI	LL	PI	MC	Description
0								SILTY SAND, dark brown, damp, very soft, fine sand, 10% non-plastic fines, top 0.6' contains grass roots. (F)
SM	2	–	–	–	–	–	–	1.3', brown and light reddish brown, larger percent fines.
SC	23	–	–	–	–	–	–	*CLAYEY SAND, yellowish brown, moist, stiff, 70% fine to medium sand, some slightly to moderately cemented zones, medium plastic fines.
4.6' SM	29	–	–	–	–	–	–	SILTY SAND, light reddish brown, damp, firm to slightly cemented, fine sand, small percent non-plastic fines. (F)
6.5'	58	–	–	–	–	–	–	As above, brown to light reddish brown, saturated, firm to dense, fine sand, 10%-15% non-plastic fines, scattered gravel to 1-1/2" maximum diameter. (F)
7.5' GC		74	19	7	–	–	–	*GRAVEL, dark brown, rounded gravel to 3" maximum diameter, few rounded cobbles to 5" diameter, medium plastic fines
9.0' ML	–	15	18	67	41	13	22	GRAVELLY SANDY SILT, greenish gray, damp, very firm to dense, fine to coarse sand, rounded gravel to 1" maximum diameter.
	46							From 10.0', thin sandy zones with orange iron oxide stains.
12.0' SC	61	–	–	–	–	–	–	SANDY CLAY, greenish gray with orange iron oxide stains, damp, stiff to hard, 35% very fine to fine sand, medium plastic fines.
15.5'	31							
ML	27	–	21	79	37	14	25	SANDY SILT, light olive brown with orange iron oxide stains, moist, firm, fine to medium sand.
19.5'	29							
	35	–	–	–	–	–	–	*SILTY SAND, yellowish brown, iron oxide stained, moist, stiff to very stiff, 60% fine to medium sand, medium plastic fines.
SM	29	–	–	–	–	–	–	
23.5'								23.5', same as above. (F)
	38	–	–	–	–	–	–	
25.5'								

Drilled 16 - 18 December 1976

2 F - 8 (ELEV. 205.5)

Depth	N	GR	SA	FI	LL	PI	MC	Description
0								
	9							
SC	–	–	–	–	–	–	–	*GRAVELLY CLAYEY SAND, dark grayish brown, some iron oxide stains, moist, soft to stiff, 40% graded sand, 45% medium plastic fines, scattered angular to rounded gravel to 1" diameter, grass roots in top 0.5 foot.
	12							
5.0'	24							
	–	–	45	55	–	–	–	*SANDY SILT, yellowish tan, damp, firm, fine to medium sand, non-plastic fines, some cementation.
7.0' ML	63							
	–	–	7	93	38	9	21	SILT, pale olive with orange iron oxide stains, damp, very firm to dense, fine to medium sand.
9.0'	68							
SC	–	–	–	–	–	–	–	CLAYEY SAND, grayish brown with iron oxide stains, damp, hard, fine sand, 20% medium plastic fines. (F)
10.5'								
	23							
SM	51	–	–	–	–	–	–	*SILTY SAND, pale olive with orange iron oxide stains, moist, firm to dense, partly cemented, 55% fine to medium sand, nonplastic fines.
15.2'	23							
CL	–	–	1	99	45	20	26	CLAY, light grayish brown, moist, stiff to very stiff.
17.0'	58							
	–	–	–	–	–	–	–	SILTY SAND, gray, damp, very firm, fine to medium sand, scattered white pumice grains, 15% non-plastic fines. (F)
18.5'								18.5', tan with orange iron oxide stains.
	30							
SM	–	–	82	18	–	–	–	
	27							*21.0', more iron oxide stained than above.
22.0'								
	28							*CLAY, pale olive, moist, stiff fine to medium sand, some cementation, 90% medium plastic fines
24.0' CL								
	21	–	14	86	47	29	33	SANDY CLAY, light brownish gray, moist, firm to stiff, fine to medium sand.
25.5'								

Drilled 18 December 1976

2 F - 9 (ELEV. 213.2)

Depth	N	GR	SA	FI	LL	PI	MC	Description
0								
	9							
SC	–	–	–	–	–	–	–	CLAYEY SAND, grayish brown, damp, soft to firm, fine sand, slightly cemented, medium plastic fines. (F)
2.5'	–	–	–	–	–	–	–	SAND, yellowish brown, damp, very loose, fine to medium sand, very small percent fines. (F)
3.0'	12							
ML	–	–	100	43	10	33		SILT, light brownish gray with iron oxide stains, moist, loose to very firm, slight cementation.
5.5'	48							
	12							
SM	–	–	90	10	–	–	–	SILTY SAND, grayish brown, loose to firm, damp, fine to medium sand, nonplastic fines.
	25							
9.3' CL	–	–	21	79	31	10	–	SANDY CLAY, brown, damp, very stiff to hard, very fine to medium sand, slightly cemented.
10.5'								
SC	R	–	–	–	–	–	–	CLAYEY SAND, brown, damp, very stiff to hard, fine sand, micaceous, small percent low plastic fines. (F)
12.0'								
	34							
ML	–	–	21	79	27	6	18	SANDY SILT, grayish brown with iron oxide stains, damp, firm to very firm, fine to medium sand, slightly cemented.
15.0'	40							
	26							SILTY SAND, brown, highly iron oxide stained, damp, loose to very firm, cemented zones, 10% non plastic fines. (F)
	–	–	–	–	–	–	–	
								18.5', 0.1' cemented layer.
SM	16							
	16	–	94	6	–	–	–	SILTY SAND, brownish gray, damp, loose to firm, fine to medium sand, non plastic fines.
23.0'	31							
SC	–	–	–	–	–	–	–	CLAYEY SAND, grayish brown, damp, stiff, fine sand, scattered white pumice grains, medium plastic fines. (F)
24.5' ML	51	–	–	–	–	–	–	*SANDY SILT, olive gray, moist, firm to dense, moderately cemented, graded sand, scattered white pumice grains, 55% low plastic fines.
25.5'								

Drilled 19 December 1976

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4	Less than 5% fines	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		More than 12% fines	GM	Silty gravels, gravel-sand silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing the No. 4	Less than 5% fines	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		More than 12% fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands, or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and Above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 50%.

(SW) indicates symbol based on field classification.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

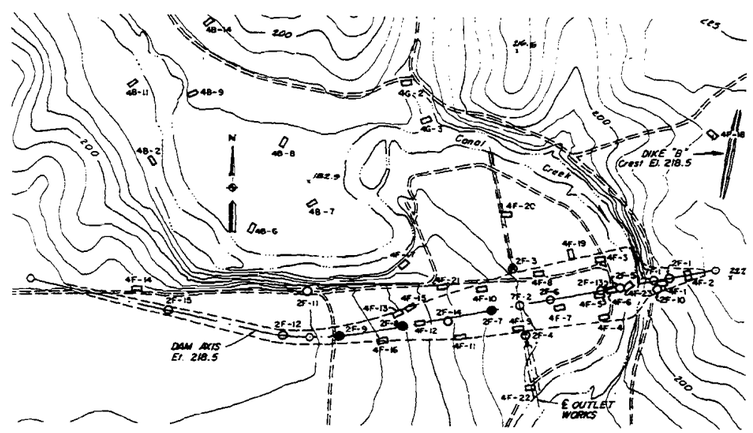
*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1 3/8-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- (F) Visual Field Classification.
- R Refusal with Standard Penetrometer.
- * Laboratory Visual Classification.
- MC Field Moisture Content in Percent of Dry Weight.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- N Number of Blows of Standard Penetrometer.
- ELEV. Elevations scaled from topographic map.
- ** Classification based on laboratory gradation and visual field description.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (MIL-STD-619B).
2. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
3. All sieve sizes on this chart are U.S. Standard.
4. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (MIL-STD-619B) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.



LOCATION OF EXPLORATION

GRAPHIC SCALE

1 Inch = 200 Feet 0' 200' 400' 600' 800' 1000'

GRAPHIC SCALE

1 Inch = 2 Feet 0' 1' 2' 4' 6' 8' 10'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DRAWN BY: T.J.S., R.L.T.
CHECKED BY: J. B. Moses, R.L. Treat
PREPARED BY: R.L. Treat

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF FOUNDATION DRILL HOLES
2F-7 THRU 2F-9

SUBMITTED: Robert L. Jewett, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET CG-5 30
FILE No. ME-12-4-19

2F-10 (EL. 207.3)

Depth		N	GR	SA	FI	LL	PI	MC	
0									
	CL		-	(35)	(65)	-	-	-	* SANDY CLAY, very dark grayish brown, medium plasticity, 35% medium sand, rootlets
1.0'		5							
			-	(20)	(80)	-	-	-	* As above, olive-gray, damp
2.0'									
		R	-	(10)	(90)	-	-	15.4	* CLAY, olive-gray, damp, medium plasticity, medium sand
6.0'									
		42							
	CL-ML		-	43	57	27	6	-	SANDY CLAY, tan, damp, very fine to fine (some medium) micaceous sand, trace of iron oxide staining
7.2'		35							
7.5'	SP-SC		-	94	6	-	-	-	CLAYEY SAND, gray, tan, damp, fine to medium (mostly medium) subangular sand
	CL	86	-	26	74	30	8	-	SANDY CLAY, grayish brown, damp, very fine sand, some iron oxide staining and carbonaceous material
10.0'									
	SM	29	-	54	46	-	-	8.9	** SILTY SAND, tan, very fine to medium (mostly fine) sand, some iron oxide staining
12.5'									
		37							
		41	-	(15)	(85)	-	-	-	* SANDY CLAY, light olive-brown, damp, medium plasticity, very fine (some micaceous) sand, some iron oxide staining and carbonaceous material
		30							
18.0'									
		27							
	CL		-	(40)	(60)	-	-	-	* As above, except low plasticity, micaceous sand
		35							
22.0'									
		67							
		25							
			-	1	99	-	-	-	** CLAY, grayish brown, damp, medium plasticity, some carbonaceous material
30.0'									

Continued

2F-10 Continued

Depth		N	GR	SA	FI	LL	PI	MC	
30.0'									
		28							
	CL		-	(15)	(85)	-	-	-	* SANDY CLAY, brown, damp, medium plasticity with some carbonaceous material, some iron oxide staining, very fine to medium sand
35.0'									
		33							
			-	(10)	(90)	-	-	-	* CLAY, yellowish brown, damp, medium plasticity, medium grained sand, small amounts of carbonaceous material
40.0'									
		35							
	SC		-	81	19	28	8	6.0	CLAYEY SAND, tan, very fine to fine (some medium) sand, some iron oxide staining, micaceous sand
45.0'									
		38							
	SM		-	57	43	24	3	-	SILTY SAND, tan, damp, very fine to fine medium micaceous sand, some iron oxide staining
48.5'									
	CH	20	-	(10)	(90)	-	-	-	* CLAY, yellowish red, damp, highly plastic, fine grained sand, micaceous, carbonaceous material
50.0'									
	SC								
	CL		-	(20)	(80)	-	-	-	* SANDY CLAY, yellowish brown, damp, medium plastic fines, fine to medium sand
55.0'									

Drilled 17-18 Dec 1981

2F-11 (EL. 214.6)

Depth		N	GR	SA	FI	LL	PI	MC	
EL. 214.6' = 0									
		9							
	CL		1	42	57	-	-	-	** SANDY CLAY, dark brown and brown, damp, medium plasticity, very fine to coarse grained sand, gravel to 3/8-inch diameter, traces of organic material and iron oxide staining
		16							
3.5'									
	SC	14	8	49	43	32	13	17.1	CLAYEY SAND, brown, very fine to coarse sand, gravel to 3/4-inch diameter
6.0'									
		12							
			1	45	54	-	-	-	** SANDY CLAY, mottled dark brown, brown and tan, damp, medium plasticity, fine to coarse sand, gravel to 3/8-inch diameter, some iron oxide stains and cemented nodules
		15							
10.0'									
	CL	20							
			-	44	56	-	-	-	** As above except, dark brown, slightly damp, fine to medium sands, traces of caliche, slightly cemented
		24							
14.0'									
		12	-	49	51	30	16	14.3	As above
15.0'									
		7							
	SC		-	64	36	-	-	-	** CLAYEY SAND, light brown, damp, very fine to fine (some medium) micaceous sand
		5							
19.8'									
		8							
	SP-SC								
		8							
			-	95	5	-	-	-	** As above except, brownish gray
		13							
28.0'									
	CL	64	-	(35)	(65)	-	-	-	* SANDY CLAY, olive, damp, medium plasticity, very fine to medium sand
32.5'									
			-	65	35	27	10	-	CLAYEY SAND, greenish brown, damp, very fine to fine (some medium) sand
	SC	48							
38.0'									
	SM	39	-	68	32	-	-	-	** SILTY SAND, light brown, damp, very fine to fine (some medium) sand
40.0'									

Drilled 21 JAN 1981

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4 sieve.	Clean Gravels	G W	Well-graded gravels, gravel-sand mixtures, little or no fines.
			G P	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	G M	Silty gravels, gravel-sand mixtures.
			G C	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing the No. 4 sieve.	Clean sands	S W	Well-graded sands, gravelly sands, little or no fines.
			S P	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	S M	Silty sands, sand-silt mixtures.
			S C	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50%	M L	Inorganic silts and very fine sands, rock flour, silty fine sands or silts. Plasticity below "A" line.
			C L	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			O L	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and above	M H	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			C H	Inorganic fat clays. Plasticity above "A" line.
			O H	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			P t	Peat, organic content greater than 60%.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1⅜-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

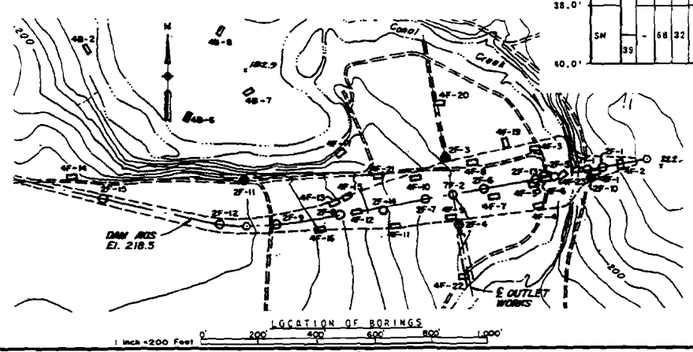
- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- MC Field Moisture Content in Percent of Dry Weight.
- ** Classification based on laboratory gradation and visual field description.
- * Laboratory Visual Classification.
- N Number of Blows of Standard Penetrometer.
- R Refusal with Standard Penetrometer.
- ( ) Estimated percent of gravel, sand and fines.
- F Visual Field Classification.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487).
2. All sieve sizes on the chart are U.S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Holes were drilled with a CME #45 using a 7-inch hollow stem auger.
6. Elevations (EL.) estimated from topo map.

GRAPHIC SCALES

1 Inch = 2 Feet: 0' 2' 4' 6' 8' 10'



REVISION	DATE	DESCRIPTION	BY	BY
△				
△				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: T. PEARSON
DRAWN: P. LEE, C. BRYANT
CHECKED: D. ANDERSON

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF BORINGS
2F-10 & 2F-11

SUBMITTED: CHIEF, SOILS DESIGN SECTION
DATE APPROVED:
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: CG-6
31
FILE No. ME-12-4-19

2F-12 (Elev. 216.2)

Depth		N	GR	SA	FI	LL	PI	MC	
0	ML	8	-	41	59	-	-	-	** SANDY SILT, reddish-brown, damp, very fine to fine (some medium) sand, micaceous, some organic material, cultivated zone
2.8'	ML	13							
	ML	76	-	34	66	30	5	27.2	As above except, brownish gray, fine to coarse sand, carbonaceous material, some iron oxide staining
	ML	41							
8.0'	SP		-	96	4	-	-	-	** SAND, gray, dry, very fine to medium sand, micaceous, loose
8.6'	CL	62	-	(35)	(65)	-	-	-	* SANDY CLAY, olive, damp, medium plasticity, medium sand, caliche streaks, carbonaceous material, iron oxide staining in some places
10.2'	SP-SC	29	-	93	7	-	-	5.2	** CLAYEY SAND, gray, very fine to fine (some medium) sand, micaceous, some iron oxide staining, loose
	SP-SC	30							
14.2'	CL	43							
	CL	59	-	(30)	(70)	-	-	-	* SANDY CLAY, light olive-brown, damp, medium plasticity, medium sand, with numerous iron oxide streaks, micaceous
	CL	57							
	CL	30							
22.0'	SM	30	-	63	37	-	-	-	** SILTY SAND, greenish-gray, damp, very fine to medium sand, micaceous, irregular streaks of iron oxide
24.6'	CL	33	-	(30)	(70)	-	-	-	* SANDY CLAY, dark olive-brown, damp, medium plasticity, medium sand, abundant carbonaceous material, some iron oxide streaks.
25.0'	SM		-	63	37	-	-	-	** SILTY SAND, gray, damp, very fine to medium sand, iron oxide stains, small amount of carbonaceous material
25.5'									

Drilled 28 Dec 1981

2F-13 (Elev 182.4)

Depth		N	GR	SA	FI	LL	PI	MC	
0	SM	7	1	63	36	-	-	-	** SILTY SAND, brown, damp, fine sand, some gravel to 3/8-inch diameter, organic material (roots)
2.5'	SM	9							
	SM	5	2	70	28	-	NP	9.3	As above except, reddish brown, very fine to fine (some medium) sand, some organic material, roots
7.0'	SM	12	2	68	30	-	-	-	** As above, moist to wet
8.0'	SC		(20)	(45)	(35)				** CLAYEY GRAVELLY SAND, yellowish brown, damp, very fine sand, rounded gravel to 1 1/2-inch diameter, medium plastic fines
8.2'	CL	22	-	(20)	(80)	-	-	-	* SANDY CLAY, yellowish brown with gray streaks, damp, medium plasticity, medium sand, thin layers of very fine to find sand
10.0'	CL	22							
	CL	23	-	30	70	-	-	-	** As above except, reddish brown with streaks of gray, very fine sand, micaceous
16.0'	CL	17							
	SC-SM	19	-	66	34	25	5	23.9	CLAYEY SAND, brown, very fine micaceous sand
18.0'	CL	21	-	(15)	(85)	-	-	-	* SANDY CLAY, yellowish red, damp, medium plasticity, very fine micaceous sand
18.0'	SM	25	-	(75)	(25)	-	-	-	* SILTY SAND, yellowish red, damp, very fine micaceous sand, low plastic fines
22.0'	SC-SM	25							
	SC-SM	28	-	58	42	-	-	-	** CLAYEY SAND, brown, damp, very fine to fine sand, micaceous
27.5'	SC-SM	45	-	59	41	25	7	-	As above except, yellowish brown, very fine to medium sand
33.5'	SC-SM		3	73	24	-	-	-	** As above except, brown with 0.1-foot clean sand zone at 35.0', very fine to medium micaceous sand, gravel to 2/8-inch diameter
35.2'	SC	8							
	SC		-	(60)	(40)	-	-	-	* As above except, light olive-brown, medium grained micaceous sand, medium plastic fines
40.0'									

Continued

2F-13 (Continued)

Depth		N	GR	SA	FI	LL	PI	MC	
40.0'	SM	43	-	72	28	-	-	-	** SILTY SAND, brown, damp, very fine to medium grained micaceous sand
44.5'	SP-SM	50	-	90	10	-	-	-	** As above except gray, saturated, fine to medium micaceous sand, loose
48.5'	SC-SM	32	1	54	45	20	5	-	CLAYEY SAND, reddish brown, damp, to moist, very fine to medium sand, gravel to 3/8-inch diameter, some carbonaceous material
55.0'	SC	62	-	69	31	-	-	-	* As above except, brown, fine to medium sand, medium plastic fines
59.0'	SW-SC	54	-	92	8	-	-	-	** As above except gray, fine to medium micaceous sand
65.0'									

Drilled 22 Dec 1981

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4 sieve.	Clean Gravel	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravel with fines	GM	Silty gravels, gravel-sand mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing the No. 4 sieve.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 60%.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1 3/8-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

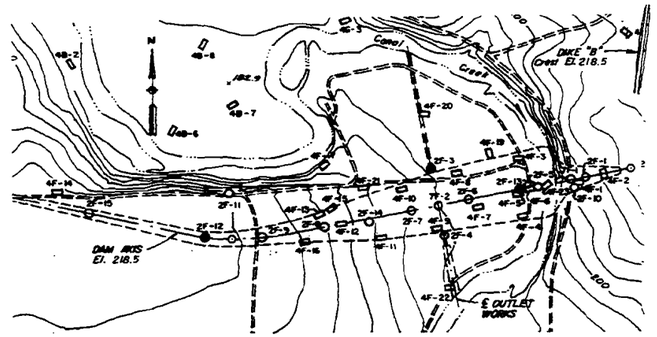
- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- MC Field Moisture Content in Percent of Dry Weight.
- ( ) Estimated percent of gravel, sand and fines.
- * Laboratory Visual Classification.
- N Number of Blows of Standard Penetrometer.
- R Refusal with Standard Penetrometer.
- ** Classification based on laboratory gradation and visual field description.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487).
2. All sieve sizes on the chart are U.S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Holes were drilled with a DIE M45 using a 7 inch hollow stem auger.
6. Elevations (Elev.) estimated from topo map.

GRAPHIC SCALES

1 Inch = 2 Feet: 0, 1', 2', 4', 6', 8', 10'



LOCATION OF BORINGS

1 Inch = 200 Feet: 0, 200', 400', 600', 800', 1,000'

REVISION	DATE	DESCRIPTION	BY	BY
△				
△				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: T. PEARSON
DRAWN: P. LEE, C. BRYANT
CHECKED: D. ANDERSON

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF BORINGS
2F-12 & 2F-13

SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED
SCALE: AS SHOWN | SPEC. No. 6352A
SHEET CG-7 | 32
FILE No. ME-12-4-19

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

2 F - 1 4 (Elev. 196.5)

Depth	Class	N	GR	SA	FI	LL	PI	MC	Description
0 – 3.0'	SM	3	-	62	38	-	-	-	** SILTY SAND, dark brown, damp, very fine to fine (some med.) sand, some organic material, some clay lenses
3.0' – 6.5'	SC	6, 12	-	61	39	-	-	-	** CLAYEY SAND, reddish brown, damp, very fine to medium sand, low plastic fines
6.5' – 8.3'	SM	7	-	65	35	-	-	9.9	** SILTY SAND, reddish brown, very fine to medium sand.
8.3' – 10.2'	SM	11	-	83	17	-	-	-	** As above, but less fines
10.2' – 12.0'	SC	26	-	(60)	(40)	-	-	-	* CLAYEY SAND, dark brown, damp, medium sand, medium plastic fines
12.0' – 14.0'	CL	32	-	(10)	(90)	-	-	-	* CLAY, light yellowish brown, damp, medium plasticity, fine sand, some streaks of iron oxide stain
14.0' – 16.0'	CL	48	-	(10)	(90)	-	-	-	* As above, olive-yellow, damp, medium plasticity, very fine sand, some streaks of reddish iron oxide stains and carbonaceous material
16.0' – 16.5'	CL-ML		-	47	53	25	6	16.4	SANDY CLAY, brown, very fine to fine (some medium) sand, some organic material
16.5' – 22.0'	CL	32, 48, 77	-	(15)	(85)	-	-	-	* As above, yellowish brown, damp, medium plasticity, very fine to fine sand, carbonaceous material
22.0' – 22.7'	SM		-	69	31	-	-	-	** SILTY SAND, grayish brown, damp, very fine to fine micaceous sand, loose
22.7' – 24.3'	CL	50	-	(20)	(80)	-	-	-	* SANDY SILTY CLAY, yellowish brown, damp, medium plasticity, fine sand, some iron oxide streaks
24.3' – 31.0'	ML	69	-	27	73	-	-	-	** SANDY SILT, gray, damp, very fine (some medium to coarse) sand, slightly cemented, some iron oxide staining
31.0' – 35.0'	SP-SM	67	-	89	11	-	-	-	** SILTY SAND, gray, damp, very fine to medium sand.
35.0' – 35.8'	SM		-	62	38	-	-	-	** As above, except all fine sand
35.8' – 40.0'	CL	48	-	(10)	(90)	-	-	-	* CLAY, light yellowish brown, damp, medium plasticity, very fine sand, some streaks of iron oxide staining

Continued

2 F - 1 4 (Continued)

Depth	Class	N	GR	SA	FI	LL	PI	MC	Description
40.0' – 41.1'	SM	83	-	58	42	-	-	-	** SILTY SAND, brown with reddish brown, damp, fine to medium sand, iron oxide staining
41.1' – 44.0'	SM-SC		-	59	41	20	6	-	As above, except reddish brown, fine to medium angular to subangular sand, dense
44.0' – 56.0'	SP-SM	42, 43	-	95	5	-	-	-	** As above, except brown, very fine to medium angular to subrounded micaceous sand, some iron oxide staining, small percent fines
56.0' – 56.5'	CL	31	-	(5)	(95)	-	-	-	* CLAY, light olive-brown, damp, medium plasticity, fine micaceous sand, some iron oxide streaks
56.5' – 66.5'	SM	66, 56	11	72	17	-	-	-	** SILTY SAND, gray, damp to wet, very fine to medium micaceous sand, scattered subangular to subrounded gravel to 1-inch diameter, some iron oxide staining

Drilled 23 - 28 Dec 1981

2 F - 1 5 (Elev. 217.8)

Depth	Class	N	GR	SA	FI	LL	PI	MC	Description
0 – 0.5'	CL		-	38	62	-	-	-	** SANDY CLAY, dark brown, medium plasticity, fine (some medium to coarse) sand, organic material, roots
0.5' – 1.0'	CL	7	-	49	51	-	-	-	** As above, except with iron oxide stains, fine to medium sand, some cemented sand nodules
1.0' – 5.0'	CL	5	-	43	57	-	-	15.3	** As above, except mottled dark brown and tan, fine sand
5.0' – 5.5'	CL	16	-	47	53	-	-	-	** As above, except dark brown, damp, low plasticity
5.5' – 8.5'	CL	43		(30)	(70)				* As above, except medium plasticity, medium sand
8.5' – 10.0'	SC	R	-	62	38	28	12	10.7	CLAYEY SAND, brown, very fine to fine (some medium) sand, iron oxide stained
10.0' – 12.5'	CL	92	-	(40)	(60)	-	-	-	* SANDY CLAY, light olive-brown, damp, medium plasticity, very fine sand, cemented
12.5' – 14.0'	SM	50	-	64	36		NP	-	SILTY SAND, grayish brown, damp, very fine to fine micaceous sand, traces of iron oxide staining
14.0' – 16.5'	SP-SM	20							** As above except, gray, very fine to fine grained sand
16.5' – 18.0'	SC	60	-	53	47	32	12	-	CLAYEY SAND, grayish brown, damp, very fine to medium sand
18.0' – 20.0'	CL	38	-	(15)	(85)	-	-	-	* SANDY SILTY CLAY, light olive-brown, damp, medium plasticity, very fine to fine sand, traces of iron oxide staining

Drilled 18 Dec 1981

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on the No. 4 sieve.	Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing the No. 4 sieve.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 60%.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1⅜-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- MC Field Moisture Content in Percent of Dry Weight.
- ** Classification based on laboratory gradation and visual field description.
- * Laboratory Visual Classification.
- N Number of Blows of Standard Penetrometer.
- R Refusal with Standard Penetrometer.
- ( ) Estimated percent of gravel, sand and fines.

NOTES:

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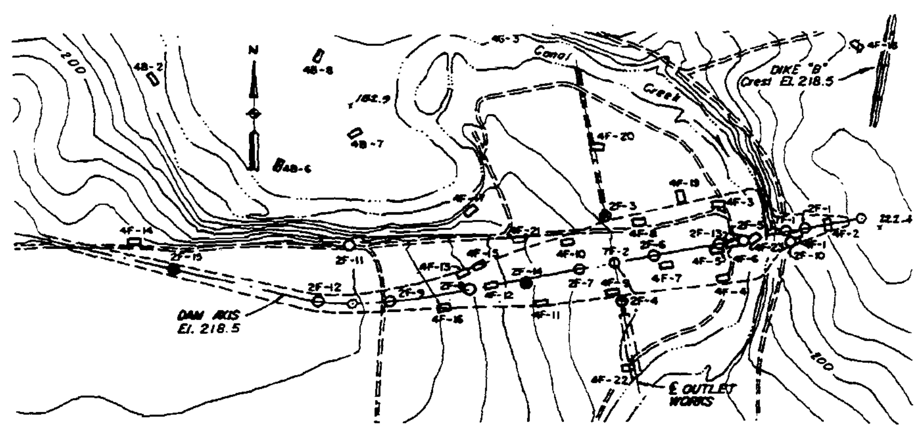
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Holes were drilled with a CME #45 using a 7-inch hollow stem auger.
6. Elevations (Elev.) estimated from topo map.

GRAPHIC SCALE

1 Inch = 2 Feet 0 1' 2' 4' 6' 8' 10'



LOCATION OF BORINGS

1 Inch = 200 Feet 0' 200' 400' 600' 800' 1,000

REVISION	DATE	DESCRIPTION	BY	BY
△				
△				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: T. Pearson
DRAWN: P. Lee, C. Bryant
CHECKED: D. Anderson

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

LOGS OF BORINGS
2F-14 & 2F-15

SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET CG-8 33
FILE No. ME - 12 - 4 - 19

PLATE 36

2F-16 (EL. 211.0)

Depth		N	GR	SA	FI	LL	PI	MC	
0	SM	9							** SILTY SAND, dark brown, very fine to fine (some medium) sand, abundance of organic material
		2	-	73	27	-	-	9.0	
4.2'	SC	55							* CLAYEY SAND, yellowish red, damp, very fine to fine sand, low plastic fines, trace of gravel to 3/8-inch diameter
		82	-	(70)	(30)	-	-	-	
8.0'	SM	4							** SILTY SAND, reddish brown, damp, fine to medium sand, loose
		24	-	79	21	-	-	v	
13.2'	ML	53							SANDY SILT, gray, damp, fine to coarse sand, irregular streaks of carbonaceous material and iron oxide staining
			-	48	52	39	9	-	CLAYEY SAND, yellowish brown, damp, very fine sand, low plastic fines, trace of gravel to 3/8-inch diameter, some carbonaceous material
14.6'	SP-SM	22	-	(70)	(30)	-	-	-	SILTY CLAYEY SAND, light yellowish brown, damp, low plastic fines, irregular streaks of carbonaceous material and iron oxide staining, cemented particles
15.2'	SC		-	(80)	(20)	-	-	-	
15.5'									

Drilled 28 Dec 1981

2F-17 (EL. 211.0)

Depth		N	GR	SA	FI	LL	PI	MC	
0	SC-SP	12	-	(90)	(10)	-	-	-	** CLAYEY SAND, dark brown, damp, very fine to fine sand, low plastic fines
2.0'	SW-SC	7	-	58	42	17	5	8.0	SILTY SAND, dark brown, very fine to medium sand, organic material
4.5'	SM	72	-	(70)	(30)	-	-	-	* As above, except very dark brown, damp, some carbonaceous material
		55							
8.0'	SC	20							
		19	-	83	17	30	14	-	CLAYEY SAND, brown, damp, very fine to medium (some coarse) sand, iron oxide staining, soft
		13							
14.2'	SP	11	-	97	3	-	-	-	** SAND, gray to brown, damp, fine to medium grained abundant quartz sand, micaceous, loose
15.5'									

Drilled 28 Dec 1981

2F-18 (EL. 260.0)

Depth		N	GR	SA	FI	LL	PI	MC	
0	ML		-	34	66	-	-	-	** SANDY SILT, dark brown, damp to moist, very fine to fine (some medium) sand, some iron oxide staining
0.5'	GM	42							
		16	-	62	18	20	-	-	9.2	* SANDY SILTY GRAVEL, brown, fine to coarse gravel to 2-inch diameter, well rounded cobbles to 4-inch diameter, very fine to coarse scattered sand, iron oxide staining
		29							
8.6'	SW-SC		-	90	10	-	-	-	** CLAYEY SAND, brown, damp, fine to coarse (mostly medium) angular to subrounded sand, scattered well rounded gravel to 1-inch diameter, well cemented, moderately weathered
11.5'	SC	36							
			(15)	(50)	(35)	-	-	-	* CLAYEY GRAVELLY SAND, yellowish brown, damp, fine to coarse angular to subangular sand, weathered subrounded gravel to 1-inch diameter, medium plastic fines, moderately cemented, iron oxide stained in places
		38							
16.0'		26	-	(80)	(20)	-	-	-	* CLAYEY SAND, yellowish red, fine to medium grained angular to subangular sand, low plastic fines, micaceous, moderately cemented, iron oxide stained
18.0'	CL		-	(10)	(90)	-	-	-	
			-	16	86	45	21	-	CLAY, gray to brown, damp, very fine to fine (some medium) sand, micaceous
		38							
20.0'									

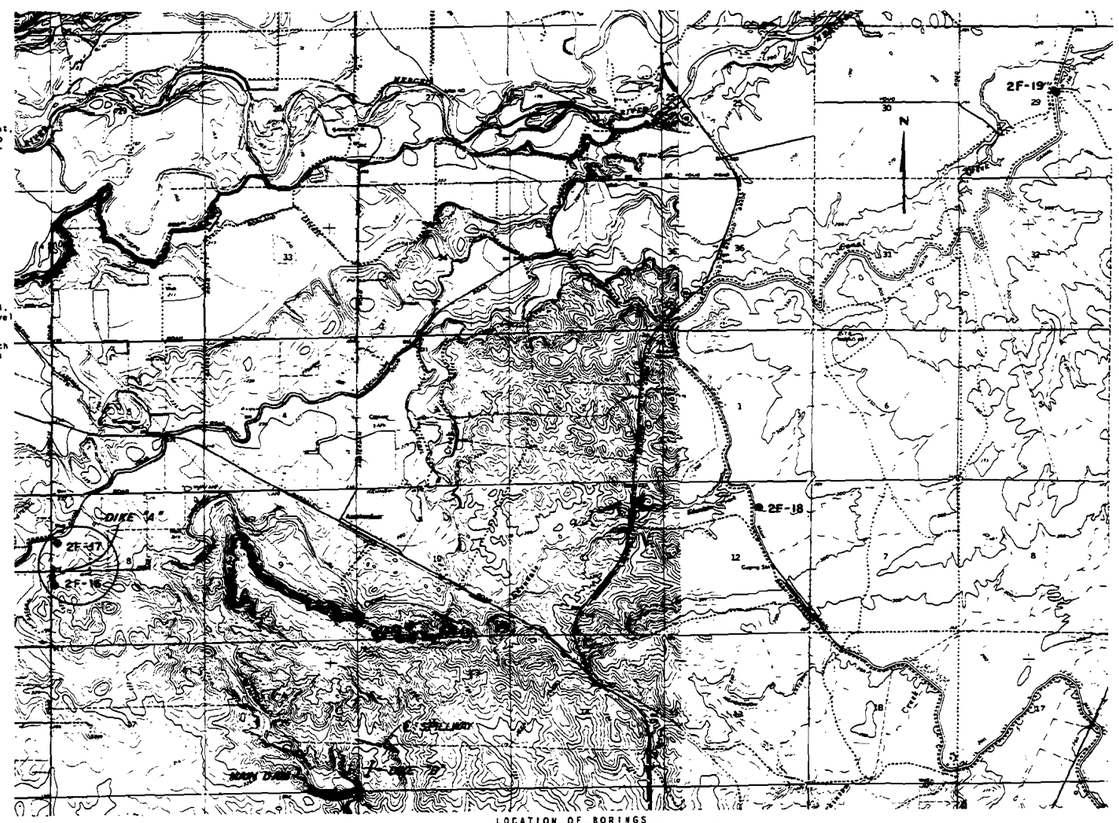
Drilled 29 Dec 1981

2F-19 (EL. 272.0)

Depth		N	GR	SA	FI	LL	PI	MC	
0			6	49	(45)	-	-	-	** CLAYEY SAND, brown, damp, very fine to medium (some coarse) sand, low plastic fines, gravel to 3/8-inch diameter
0.5'	SC	9							
		3							
		3							
		3							
		13							
Water table 29 Dec.1981									
10.4'		34							
	GC	A	50	34	16	-	-	-	** GRAVELLY CLAYEY SAND, dark brown, damp, moist, fine to medium (some coarse) sand, medium to highly plastic fines, gravel to 1-inch diameter, ground water at a depth of 10.4 feet
14.0'									CLAYEY SANDY GRAVEL, brown, wet to saturated, fine to coarse subangular to subrounded gravel to 1/2-inch diameter, very fine to coarse angular to subrounded sand, medium plastic fines, some well rounded cobbles to 5-inch diameter, iron oxide staining in some places

Drilled 29 Dec 1981

Drill refusal at 14.0 feet.



UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material is retained on the No. 200 sieve.	GRAVELS More than 50% of coarse fraction retained on the No. 4 sieve.	Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than 50% of coarse fraction passes the No. 4 sieve.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid Limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 50%.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

*Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1⅜-inch I.D. sampler driven by a 140-lb. hammer, 30-inch freefall.

LEGEND:

- ● Location of Exploration:
- GR Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
- SA Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
- FI Fines, percent by weight passing the No. 200 sieve.
- LL Liquid Limit.
- PI Plasticity Index (Liquid Limit Minus Plastic Limit).
- MC Field Moisture Content in Percent of Dry Weight.
- ** Classification based on laboratory gradation and visual field description.
- * Laboratory Visual Classification.
- N Number of Blows of Standard Penetrometer.
- ( ) Estimated percent of gravel, sand and fines.
- A Attempt with Standard Penetrometer.
- R Refusal with Standard Penetrometer.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487).
2. All sieve sizes on the chart are U.S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Holes were drilled with a CME #45 using a 7-inch diameter hollow stem auger.
6. Holes 2F-16 & 17 are at Dike A and 2F-18 & 19 are at the check structures. (NLC)
7. Elevations (EL.) estimated from topo map.
8. Areal map is a composite from the Winton and Yosemite Lake 7.5' Quad Sheets, USGS.
9. All elevations refer to National Geodetic Vertical Datum of 1929.

GRAPHIC SCALES

1 inch = 2 Feet 0' 2' 4' 6' 8' 10'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY
△				
△				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: T. PEARSON
DRAWN: C. BRYANT, P. LEE
CHECKED: D. ANDERSON

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA

CASTLE DAM AND RESERVOIR

LOGS OF BORINGS

2F-16 thru 2F-19

SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED: 27 Mar 82
SCALE: AS SHOWN | SPEC No. 63524
SHEET CG-9 34 | FILE No. ME-12-4-19

7 F - 1 (EL. 207.3±)

Depth		GR	SA	FI	LL	PI	SG	MC	γd	
0	ML	-	-	-	-	-	-	-	-	SANDY SILT, light brown, slightly damp, very fine to fine grained sand, organic with roots
2.0'										
5.0'	ML	-	38	62	38	12	2.7	20	87	SANDY SILT, olive-brown, iron stained, damp to moist, friable, micaceous, small isolated brittle clay lumps and numerous blackened tubular voids
7.8'										
10.3'	ML	-	-	-	-	-	-	-	-	
12.8'										
15.3'	ML	-	22	78	36	12	-	33	87	
17.0'	SC	-	60	40	28	9	-	20	102	CLAYEY SAND, brown, iron stained, slightly damp, very fine to fine grained, micaceous, cemented, blackened tubular voids.
19.5'	SM-SC	-	59	41	26	5	-	21	102	SILTY SAND, light tan, damp, fine to medium grained, cemented, firm.
20.8'										
22.0'	ML	-	6	94	41	13	2.7	25	94	SILT, tannish brown, [illegible] micaceous dense, brittle, thinly laminated with isolated sand pockets and blackened tubular voids.
24.5'	CL	-	19	81	46	22	-	30	86	SANDY CLAY, light tan, moist, [illegible] grained sand, cemented, blackened tubular voids, fractured, some montmorillonite and minor kaolinite in clay fractions.
27.0'	ML	-	13	87	42	14	-	27	92	
		-	12	88	40	14	-	26	94	SANDY SILT, light tan, moist, firm, slightly cemented, blackened tubular voids, fractures throughout sample, silt fraction contains 18% calcium montmorillonite, at 27' to 29.5'
32.0'										
34.5'	CL	-	20	80	38	15	2.8	28	92	SANDY CLAY, mottled olive-tan to cream, moist, micaceous, very stiff, numerous blackened tubular voids
39.5'	SM	-	71	29	-	-	-	-	-	SILTY SAND, light tan to brown, some iron staining, damp to moist, very fine to medium grained, micaceous, firm, some blackened tubular voids
		-	52	48	-	-	-	-	-	
44.5'	ML	-	48	52	-	-	-	-	-	SANDY SILT, tannish brown to brown, iron stained, moist, very fine to medium grained sand, micaceous, soft to firm
48.3'	ML-CL	-	-	-	-	-	-	-	-	SILTY CLAY, reddish brown, [illegible] iron stained, moist, micaceous, slightly plastic
49.5'	CL	-	38	62	-	-	-	-	-	SANDY CLAY, light brown, iron stained, moist, micaceous, stiff, loose coarse grained sand, [illegible] chunks of [illegible]
50.0'										
	SP-SM	-	-	-	-	-	-	-	-	SAND, clean, fine to coarse grained, possible water table
53.0'	CL	-	-	-	-	-	-	-	-	SANDY CLAY, grayish brown, minor iron oxide stains, moist, micaceous, stiff, fine grained sand
54.0'	SM	-	78	72	-	-	-	-	-	
56.5'										
56.9'	SP-SM	1	92	7	-	-	-	-	-	SILTY SAND, light tan, moist to wet, micaceous, firm, fine to coarse grained, poorly graded sand
										As above except light brown, wet
61.7'										

Drilled 16-18 April 1980

NOTES:

1. Appreciable water loss between 16' and 28' during drilling and 14 sacks of drill mud were used. Water stabilized at 50' after drilling. Hole caved in to 55'.
2. Blackened tubular voids from 2' to 44.5' range from approximately 1/16" to 1/8" in diameter.

7 F - 2 (EL. 185.2±)

Depth		GR	SA	FI	LL	PI	SG	MC	γd	
0	ML	-	-	-	-	-	-	-	-	SANDY SILT, dark brown, slightly damp, soft, traces of organic matter
1.5'										
3.0'										
5.0'	SP	-	-	-	-	-	-	-	-	GRAVELLY SAND, brownish gold, slightly moist, micaceous, medium to coarse grained sand
6.3'	SM	1	81	18	-	-	-	-	-	SILTY SAND, brown to cream, iron stained, damp, soft to firm, micaceous, fine to coarse grained, mostly medium grained
10.0'										
11.0'	SC	1	50	49	35	16	2.7	21 13	107	CLAYEY SAND, tannish gold to light tan, iron stained, damp to wet, micaceous, subangular to subrounded medium to coarse grained sand, weakly cemented, soft, numerous clay lumps
		-	64	36	29	13	2.7	16	-	
		-	80	20	-	-	-	-	-	
14.9'	SP-SC	-	91	9	28	13	2.7	12	94	
17.4'	SM	-	87	13	-	-	-	-	-	
19.9'	SP-SM	1	87	12	-	-	-	-	-	SILTY SAND, tannish cream to dark brown with dark splotches, moist to wet, subangular to subrounded, fine to medium grained, compact, weakly cemented, micaceous, slightly organic, contains silt lumps
		-	89	11	-	NP	2.7	8	92	
24.7'										
24.9'		-	89	11	-	-	-	-	-	
		1	88	11	-	-	-	-	-	
27.4'	SP	-	96	4	-	-	-	12	91	SAND, multi-colored, wet, fine to medium grained
29.9'										
30.4'	SM	-	68	32	-	-	-	-	-	SILTY SAND, dark brown with black splotches to light tan, moist to wet, firm, fine to medium grained, poorly gradad, micaceous
32.3'										
32.5'		2	86	12	-	-	-	-	-	
34.6'	SP	1	95	4	-	-	-	11	97	SAND, tannish cream, moist to wet, fine to coarse, mostly medium grained, micaceous, non plastic
39.6'	ML	-	46	54	-	-	-	-	-	SANDY SILT, light tan to brown, damp to wet, firm, trace of gravel, micaceous
42.1'	SP-SM	-	91	9	-	-	-	-	-	SILTY SAND, medium to light tan, moist, low plasticity, fine to medium grained sand, firm, micaceous
44.6'	SP	-	96	4	-	-	-	16	101	SAND, fine to medium grained, trace of gravel
47.1'	SW-SM	-	89	11	-	-	-	-	-	SILTY SAND, tannish to brownish gold, some iron staining, damp to wet, non plastic to very slightly plastic, fine to medium grained, micaceous, loose to firm, poorly to well graded, clay splotches
52.1	SM	1	82	17	-	-	-	-	-	
57.1'	SC	1	57	42	-	-	-	-	-	CLAYEY SAND, beige-gray, iron stained, damp to moist, fine to medium grained, highly micaceous, firmly cemented
59.6'	SM	-	78	22	-	-	-	-	-	SILTY SAND, beige, iron stained, damp, slightly plastic, fine to medium grained, poorly to well gradad, micaceous
67.1'										
67.6'		-	87	13	-	-	-	-	-	
69.6'	CL	6	21	73	-	-	-	-	-	SANDY CLAY, gray with iron staining, moist, some subrounded gravel to 3" diameter, hard, brittle, sheared, with numerous small randomly oriented glossy slickensided surfaces. Clay fraction contains 25% calcium-magnesium montmorillonite
74.6'		6	16	80	45	28	2.7	23	101	

Drilled 18-21 April 1980

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS 50% or more retained on the No. 200 sieve.	GRAVELS More than half of coarse fraction retained on No. 4 sieve.	Clean gravel	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravel with fines	GM	Silty gravels, gravel-sand mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction passing No. 4 sieve.	Clean sand	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% passing the No. 200 sieve.	SILTS AND CLAYS	Liquid limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands, or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid limit 50% and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line.
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 60%.

LEGEND:

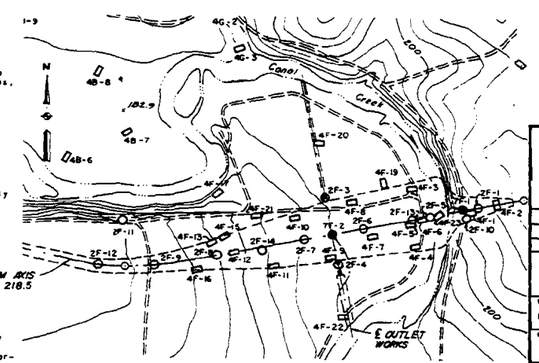
●	Location of Exploration:
GR	Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
SA	Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
FI	Fines, percent by weight passing the No. 200 sieve.
LL	Liquid Limit.
PI	Plasticity Index (Liquid Limit Minus Plastic Limit).
MC	Field Moisture Content in Percent of Dry Weight.
VS	Visual Field Classification.
X	Laboratory Visual Classification.
NP	Non-Plastic.
SG	Specific Gravity.
γd	Dry Density (lb/cu ft).

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487).
2. All sieve sizes on the chart are U.S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is a silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Elevations (EL.) scaled from topographic map.
6. Holes were drilled with a Failing 1500 using an 8-inch-diameter pitcher barrel.

LEGEND: (Continued)

▨	Undisturbed sample lost from tube.
⊗	Baggy field sample.



LOCATION OF EXPLORATION

1 Inch = 200 Feet 0' 200' 400' 600' 800' 1000'

GRAPHIC SCALE

1 Inch = 3 Feet 0 1' 2' 3' 6' 9' 12' 15'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

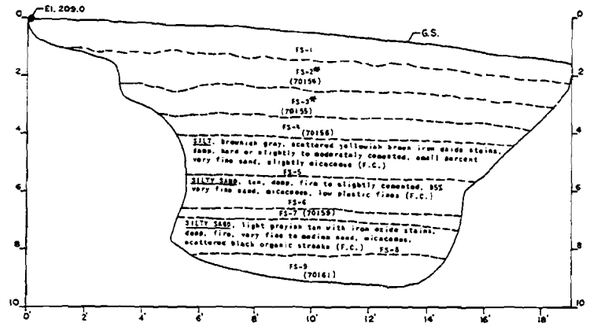
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA

CASTLE DAM AND RESERVOIR

LOGS OF FOUNDATION DRILL HOLES
7F-1 AND 7F-2

DRAWN BY: C.A.S.
CHECKED BY: D.J.A.
PREPARED BY: P.L.
SUBMITTED: Robert L. Jewett, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 Mar 87
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: CG-10 35
FILE No.: ME-12-4-19

4F-1
S 82 W



FS-1 SANDY CLAY, dark brown, moist, soft to firm, 50% very fine to fine sand, contains abundant grass roots, low plastic fines (F.C.)

FS-2 *SANDY SILT (ML), light brownish gray, damp, very stiff to hard or moderately cemented, fine sand, micaceous, scattered streaks of black organic material, 80% low plastic fines

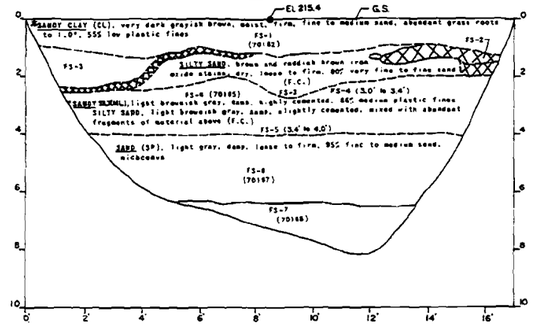
FS-3 *SILTY SAND (SM), yellowish brown, moist, soft to firm, partly cemented, 75% fine to medium sand, micaceous, low plastic fines

FS-4 SILT (ML), light gray, some yellowish brown iron oxide stains, damp, very stiff to moderately cemented, slightly micaceous, 99% medium plastic fines

FS-7 SILT (ML), light olive brown, moist, very stiff to hard or moderately cemented, fine to medium sand, micaceous, scattered black organic material and iron oxide stains, 80, medium plastic fines.

FS-9 SANDY SILT (ML), pale olive, damp, stiff, very fine to medium sand, micaceous, scattered black organic matter, 75% medium plastic fines.

4F-2
S 8 E

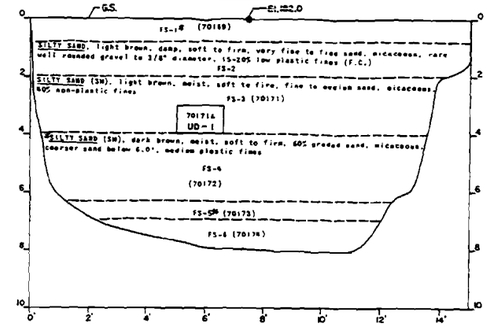


FS-2 SILTY SAND, gray with reddish brown iron oxide stains, damp, moderately cemented, fine sand (F.C.)

FS-5 SILTY SAND, light brownish gray, damp, slightly cemented, mixed with abundant fragments of material above (F.C.)

FS-7 SILT (ML), light brownish gray, damp, very stiff to highly cemented, 94% medium plastic fines.

4F-3
N 84 E

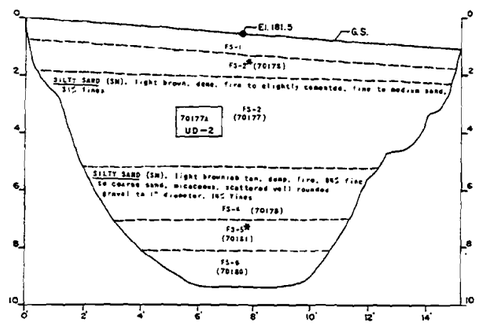


FS-1 *SILTY SAND (SM), dark brown, saturated, soft to firm, 55% graded sand, micaceous, rare well rounded gravel to 5/8" diameter, abundant grass roots, medium plastic fines

FS-5 *CLAYEY GRAVELLY SAND (SC), reddish brown, moist, firm, 57% fine to coarse sand, 30% well rounded gravel to 1-1/2" in diameter, 13% medium plastic fines

FS-6 SANDY CLAY (CL), brown, iron oxide stains, moist, very firm to stiff or moderately cemented, fine to medium sand, micaceous, 75% medium plastic fines

4F-4
N 75 E



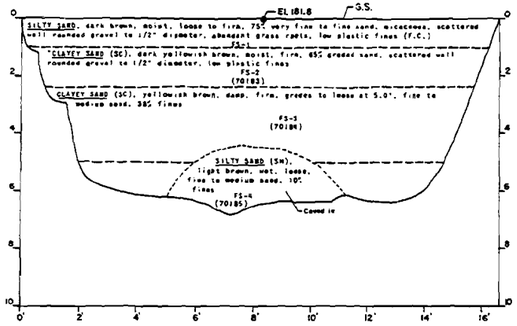
FS-1 SILTY SAND, dark brown, moist, loose to firm, very fine to fine sand, micaceous, abundant grass roots, 20% non-plastic fines (F.C.)

FS-2 *CLAYEY SAND (SC), dark brown, damp, firm to hard or slightly cemented, 65% graded sand, scattered well rounded gravel to 3/4" diameter, low plastic fines

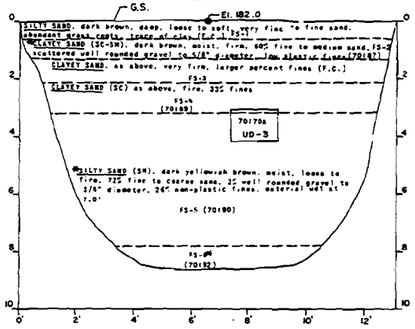
FS-5 *GRAVELLY SAND (SP), brown, damp, firm, 88% fine to coarse sand, 20% well rounded gravel to 3" maximum diameter, 5% fines

FS-6 GRAVELLY SAND (SP), tan, damp, firm, 85% fine to coarse sand, micaceous, 9% well rounded gravel to 1" diameter, 6% fines

4F-5
S 75 W

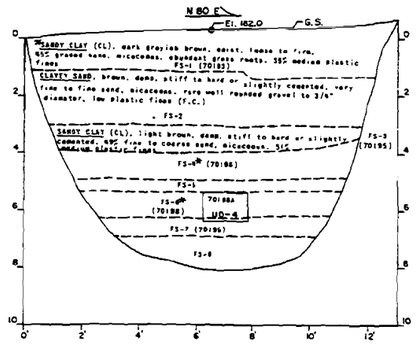


4F-6
N 80 E



FS-6 *SILTY GRAVELLY SAND (SM-SW), reddish brown, saturated, firm, 84% fine to coarse sand, 28% rounded to angular gravel to 2-1/2" diameter, 12% non-plastic fines

4F-7
N 80 E



FS-4 *CLAYEY SAND (SC), yellowish brown, moist, very firm to stiff or slightly cemented, 60% graded sand, rare rounded gravel to 5/8" diameter, low plastic fines

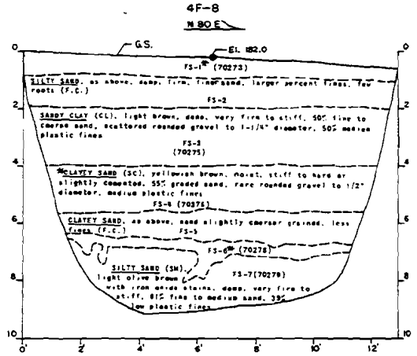
FS-5 SILTY SAND, light reddish brown, damp, firm, fine to coarse sand, micaceous, 10% fines (F.C.)

FS-6 *SILTY SAND (SM), yellowish brown, damp, loose to firm, parts slightly cemented, 77% fine to coarse sand, 5% well rounded gravel to 1-1/2" diameter, 18% low plastic fines

FS-7 CLAYEY SAND (SC), reddish brown, damp, very firm to slightly cemented, 80% fine to coarse sand, 7% well rounded gravel to 1-1/2" diameter, 13% fines

FS-8 SANDY SILT (ML), yellowish brown with reddish streaks, damp, very firm to stiff or slightly cemented, 31% fine to medium sand, 69% low plastic fines

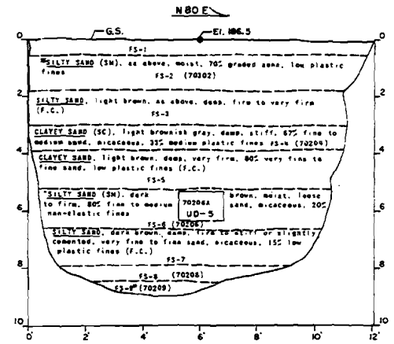
4F-8
N 80 E



FS-1 *SILTY SAND (SC-SM), dark grayish brown, moist, soft, 55% graded sand, rare rounded gravel to 1" diameter, abundant grass roots, low plastic fines

FS-6 *GRAVELLY CLAYEY SAND (SC), brown, moist, firm to very stiff, 75% fine to coarse sand, 12% rounded gravel to 3" diameter and cobbles to 4", 16% low plastic fines

4F-9
N 80 E



FS-1 SILTY SAND, dark brown, damp, soft, 80% very fine to fine sand, abundant roots, low plastic fines (F.C.)

FS-8 SANDY CLAY (CL), olive, damp, very stiff or slightly cemented, 17% fine to medium sand, 83% medium plastic fines

FS-9 *CLAYEY SANDY GRAVEL (SC-GP), reddish brown, moist, firm to stiff, 20% fine to coarse sand, 65% rounded gravel to 3" maximum diameter and rare 6" cobbles, 9% low plastic fines

EXPLANATION OF SYMBOLS

Geologic Contact Between Different Types Of Materials.

70171A UD-1 — Undisturbed Sample With Division Laboratory Number.

FS-1 (70155) — Sack Or Boggy Field Sample With Division Laboratory Serial Number, *Asterisk Denotes, Laboratory Visual Classification.

NOTES: G.S. — Original Ground Surface.

(F.C.) — Denotes Field Classification.

All Elevations Are In Feet.

Trenches Were Excavated By A Case 580 B Backhoe In December 1978.

Soils Classification Conform To Military Standard 619 B "UNIFIED SOILS CLASSIFICATION SYSTEM."

Refer To Sheet G6-1 For Location Of Trenches.

El. 182.0 — Spot Elevation Estimated From Topo Map.

GRAPHIC SCALE

1 inch = 2 Feet (0' 1' 2' 4' 6' 8' 10')

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

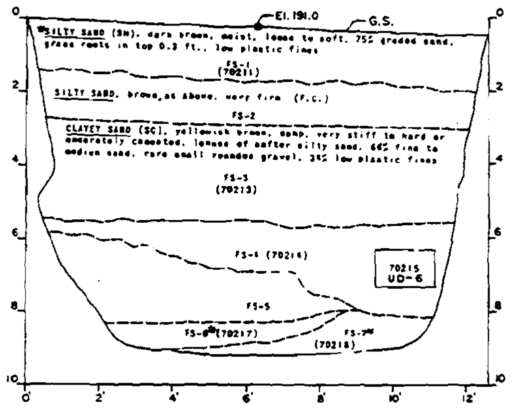
DESIGNED: R.L. TREAT
DRAWN: D.W. PAIGE
CHECKED: J.B. MOSES

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF TRENCHES
4F-1 THRU 4F-9

SUBMITTED: CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 97
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: G6-11 / 36
FILE No. ME-12-4-19

4F-10

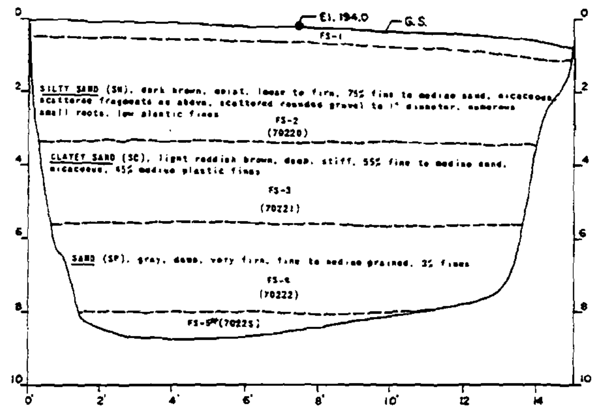
N 80 E



FS-4 SILTY SAND (SM), brown, damp, soft to firm, 80% fine to coarse sand, 3% rounded gravel to 3/8" diameter, 17% non-plastic fines
FS-5 SILTY SAND, dark brown, damp, hard or slightly cemented, fine sand, scattered well rounded gravel to 3" maximum diameter and rare cobbles to 4-1/2", small percent fines (F.C.)
FS-6 *SILTY SAND (SM), dark yellowish brown, moist, firm to slightly cemented, 65% graded sand, rare subrounded gravel to 1" diameter, 25% low plastic fines
FS-7 *GRAVELLY CLAYEY SAND (SC-SM), light brown, damp, hard or moderately cemented, 56% fine to coarse sand, micaceous, 10% well rounded gravel to 2-1/2" diameter, 34% low plastic fines

4F-11

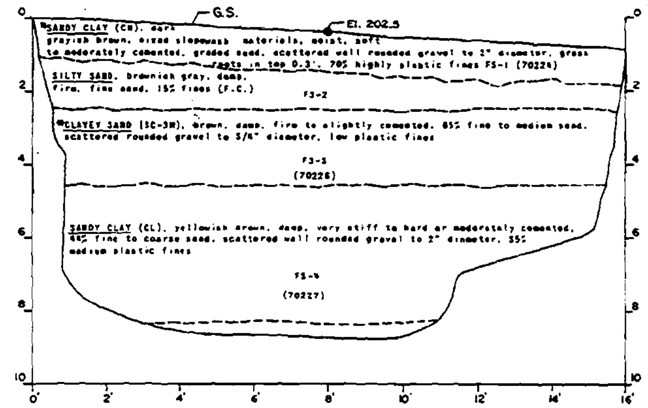
N 81 E



FS-1 SANDY CLAY, dark brown with greenish gray siltstone fragments, damp, soft, fine sand, abundant grass roots, 65% medium plastic fines (F.C.)
FS-5 *SILTY SAND (SM), brown, moist, firm, fine to medium sand, 19% low plastic fines

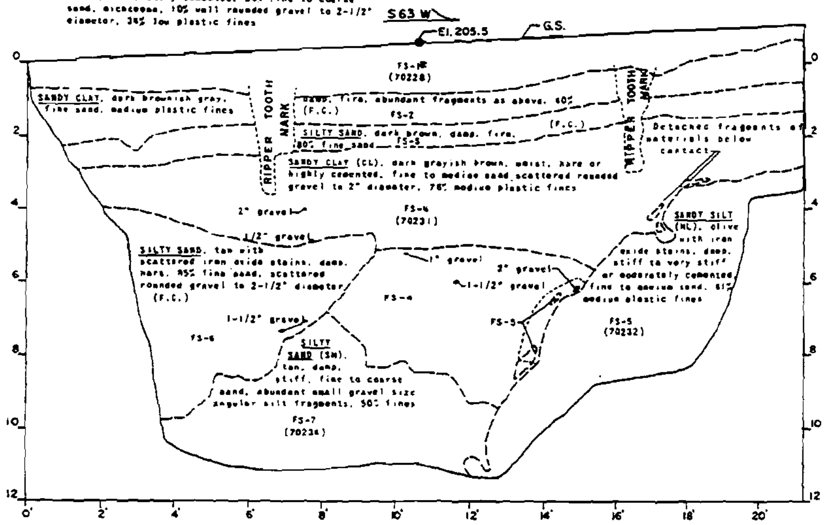
4F-12

N 81 E



4F-13

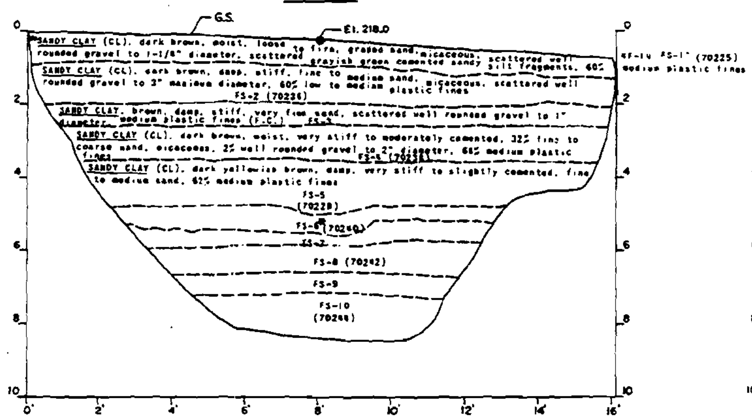
S 63 W



FS-1 *SANDY CLAY (CH), brown, moist, soft, 40% fine sand, scattered greenish gray, angular gravel size siltstone fragments, abundant grass roots in top 0.4', 60% highly plastic fines

4F-14

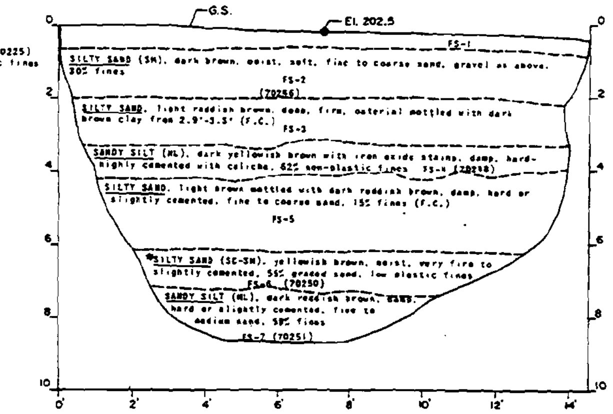
N 88 E



FS-6 *SILTY SAND (SM), light yellowish brown iron oxide stained, damp, stiff to hard or higly cemented, 65% fine to medium sand, medium plastic fines
FS-7 SANDY SILT, light greenish gray with iron oxide stains, damp, very stiff to hard or slightly cemented, 10% fine sand, micaceous (F.C.)
FS-8 SILT (ML), tan with abundant brownish yellow iron oxide streaks, damp, stiff to cemented, 6% fine to coarse sand, micaceous, 92% low plastic fines
FS-9 SILTY SAND, light yellowish brown iron oxide stained, damp, very firm, 70% very fine sand, micaceous, scattered black organic material, 20% fines (F.C.)
FS-10 SILT (ML), light brownish gray with some iron oxide stains, damp, stiff to hard or moderately cemented, very fine sand, abundant streaks of black organic material, 99% low plastic fines

4F-15

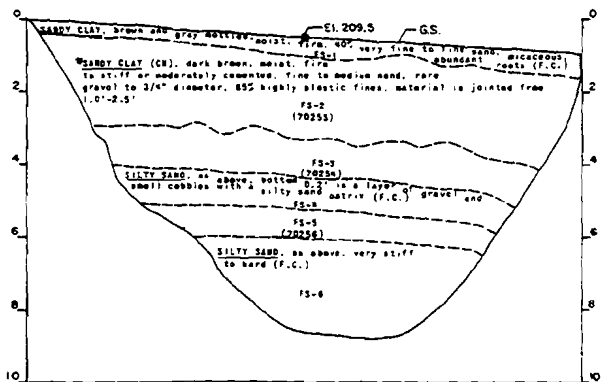
N 63 E



FS-1 SANDY CLAY, brown mottled with gray, moist, firm, scattered rounded gravel to 1" diameter, 30% very fine sand, medium plastic fines (F.C.)

4F-16

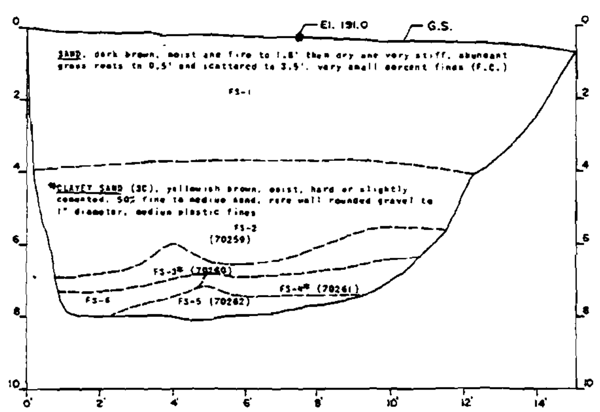
N 80 E



FS-3 SILTY SAND (SM), light reddish brown, damp, very firm to slightly cemented, sand fine to coarse, plus No. 10 sieve size particles are cemented, 45% non-plastic fines
FS-5 SILTY SAND (SM), light brownish gray with iron and manganese oxide stains, damp, very stiff to highly cemented, fine to coarse sand, 36% low plastic fines

4F-17

N 48 E



FS-2 *CLAYEY SAND (SC), brown, moist, very stiff, fine to medium sand, 24% medium plastic fines
FS-4 *SANDY CLAY (CL), yellowish brown mottled with iron oxide stains, moist, very stiff to slightly cemented, fine to medium sand, 70% medium plastic fines
FS-5 SILTY SANDY GRAVEL (GM), reddish brown, damp, firm to stiff, 63% fine to coarse sand, 68% well rounded gravel to 3" maximum diameter, 8% fines
FS-6 SAND, light brown, moist, firm, fine sand (F.C.)

EXPLANATION OF SYMBOLS AND NOTES

— — —	Geologic Contact Between Different Types of Materials.
70171A UD-1	Undisturbed Sample With Division Laboratory Number.
FS-1 (70155)	Sack Or Baggy Field Sample With Division Laboratory Serial Number, *Asterisk Denotes, Laboratory Visual Classification.

NOTES:

G.S.	Original Ground Surface.
(F.C.)	Denotes Field Classification.
	All Elevations Are In Feet.
	Trenches Were Excavated By A Case 580 B Backhoe In December 1978.
	Soils Classification Conform To Military Standard 619 B "UNIFIED SOILS CLASSIFICATION SYSTEM."
	Refer To Sheet CG-1 For Location Of Trenches.
El. 182.0	Spot Elevation Estimated From Topo Map.

GRAPHIC SCALE

1 inch = 2 Feet 0' 1' 2' 4' 6' 8' 10'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA

CASTLE DAM AND RESERVOIR

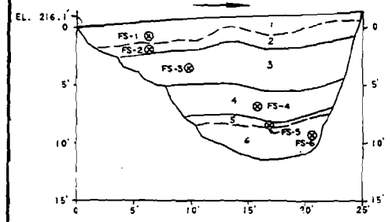
LOGS OF TRENCHES

4F-10 THRU 4F-17

Reviewed: R.L. TREAT
Drawn: D.W. PAIGE
Checked: J.B. MOSES
Submitted: Robert L. Treat, Chief, Geology Section
Date Approved: 27 M— 87
Scale: AS SHOWN | Spec. No. 6352A
Sheet: CG-12, 37 | File No. ME-12-4-19

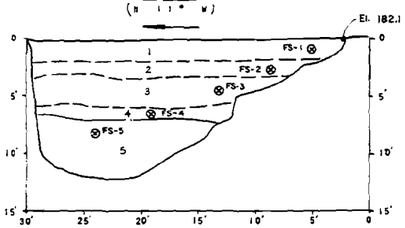
PLATE 40

4F-18 (S 48° E)



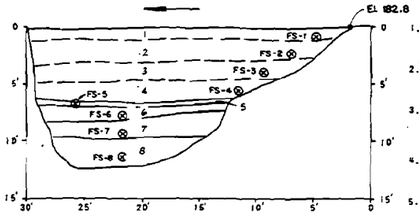
1. SANDY CLAY (CL), dark brown, moist, 56% low plastic fines (LL=21%, PI=10), 44% fine to coarse (mostly fine) angular to subrounded quartz sand, soft, noncemented
2. *SANDY CLAY (CL), reddish brown, MC=11.2%, 60% medium plastic fines, 40% medium angular to subrounded quartz sand, trace of gravel to 1-1/2-inch diameter, firm to stiff, noncemented, rootlets, numerous small slickensides scattered throughout layer
3. CLAYEY SAND (SC), reddish brown, damp, 72% fine to medium sand, 28% low plastic fines (LL=26%, PI=13), firm to very firm, slightly cemented, iron oxide stained
4. *SILTY CLAY (CL), very pale brown, damp, 95% medium plastic fines, 5% fine sand, scattered carbonaceous material, very stiff, noncemented
5. **SILTY SAND (SM), light to medium gray, damp, 73% fine to medium angular to subrounded grained quartz sand, 27% nonplastic fines, scattered mica flakes, firm, slightly cemented
6. *SAND (SP), light grayish brown, damp, 95% fine angular to subrounded quartz sand, 5% nonplastic fines, scattered mica flakes, loose, noncemented

4F-19 (N 11° W)



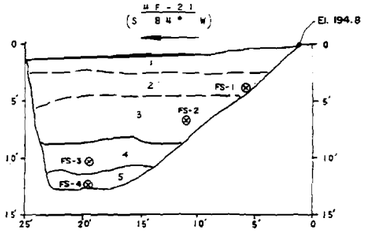
1. **SILTY SAND (SM), dark brown, moist to wet, 55% fine to medium grained sand, 44% nonplastic fines, 1% angular to subrounded gravel to 3/8-inch diameter, slightly organic, loose, noncemented
2. SILTY SAND (SM), medium brown, MC=12.3%, 56% very fine to medium subangular to subrounded grained sand, 43% nonplastic to low plastic fines (LL=19%, PI=3), 1% gravel to 3/8-inch diameter, slightly organic, loose, noncemented
3. **SILTY SAND (SM), reddish brown, damp, 61% very fine to medium grained sand with a few scattered coarse grains, 39% nonplastic fines, scattered angular to subrounded gravel to 1/2-inch diameter, loose, noncemented, slightly iron oxide stained
4. **SILTY SAND (SM), reddish brown, damp, 77% fine to medium (some coarse) angular to subrounded sand, 21% nonplastic fines, 2% subrounded to well rounded gravel to 1 1/2-inch diameter, loose to firm, noncemented, slightly iron oxide stained
5. *SANDY SILT (ML), yellowish brown, damp, 55% non to low plastic fines, 45% very fine to fine angular to subangular sand, firm to very firm, noncemented to slightly cemented, contains abundant carbonaceous streaks

4F-20 (S 86° E)



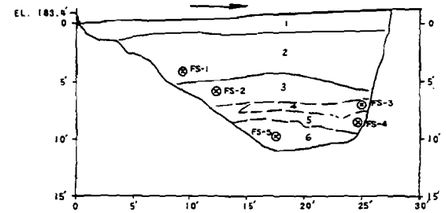
1. **SILTY SAND (SM), dark brown, moist, 61% fine to medium grained subangular to subrounded sand, 38% non to low plastic fines, 1% gravel to 1/2-inch diameter, loose, noncemented, organic (grass roots)
2. *SILTY SAND (SM), dark brown, damp to moist, 70% very fine to medium grained angular to subrounded sand, 30% low plastic fines, loose, noncemented, slightly organic,
3. SILTY SAND (SM), brown, MC=8.5%, 80% very fine to medium grained angular to subrounded sand, 39% non to low plastic fines (LL=18%, PI=3), 1% gravel to 3/8-inch diameter, firm, noncemented, organic material consists of a few grass roots.
4. **SILTY SAND (SP-SM), brown, damp, 90% very fine to medium grained angular to subrounded sand, 10% low plastic fines, trace of gravel to 3/4-inch diameter, firm, noncemented
5. **SILTY SANDY GRAVEL (GP-GM), reddish brown, damp, 45% gravel to 3-inch diameter, 39% fine to medium (some coarse) grained angular to subrounded sand, 12% fines, 4% cobbles to 4-inch diameter, very firm, slightly to moderately cemented
6. **SILTY SAND (SM), grayish brown, damp, 61% fine to medium grained angular to subrounded sand, 39% low plastic fines, firm, slightly cemented, slightly iron oxide stained, carbonaceous
7. *SANDY SILT (ML), yellowish brown, damp, 55% low plastic fines, 45% fine grained angular to subrounded sand, firm, slightly cemented
8. **SILTY SAND (SM), brown, MC=12.0%, 79% fine to medium grained angular to subrounded sand, 21% nonplastic fines, firm, slightly cemented

4F-21 (S 84° W)



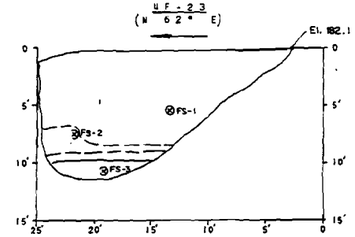
1. SILTY SAND (SM), brown, moist, est. 70-75% very fine to fine grained angular to subrounded sand, 25-30% nonplastic fines, scattered well rounded gravel to 1/2-inch diameter, loose, organic, zone has been disturbed by cultivation activities, not sampled. (F)
2. **SILTY SAND (SM), dark brown, moist to damp, 80% fine to medium grained angular to subrounded sand, 20% nonplastic fines, scattered well rounded gravel to 3/4-inch diameter, loose, slightly organic
3. **CLAYEY SAND (SC), reddish brown, MC=5.7%, 80% very fine to medium grained subangular to subrounded sand, 20% low plastic fines (LL=24%, PI=12), loose, few scattered roots
4. **SANDY CLAY (CL), reddish brown, damp, 54% low plastic fines, 46% very fine to medium grained subangular to subrounded sand, loose to very firm
5. **SILTY SAND (SM-SP), yellowish brown, damp, 90% medium grained subangular to angular sand, 10% nonplastic fines, loose

4F-22 (S 83° W)

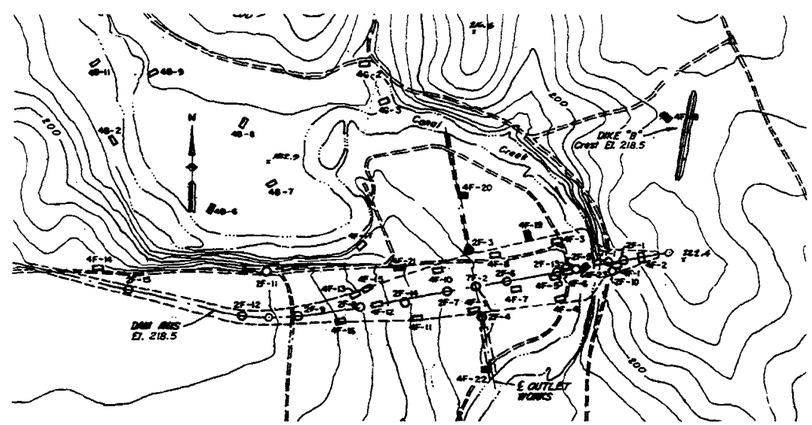


1. SILTY SAND (SM), dark brown, moist, est. 80-85% very fine to fine grained angular to subrounded sand, est. 15-25% nonplastic fines, very loose to loose, slightly organic, cultivated zone, not sampled (F).
2. **SANDY SILT (ML), brown, moist to damp, 52% nonplastic fines, 48% very fine to fine (some medium) grained angular to subrounded sand, loose, noncemented, scattered roots and organic material
3. **SILTY SAND (SM), brown, MC=18.2%, 66% very fine to fine (some medium and coarse) grained angular to subrounded sand, 45% nonplastic fines, very firm to dense, slightly cemented
4. SILTY SAND (SM-SC), reddish brown, damp, 93% very fine to medium (some coarse) grained angular to subrounded sand, 5% non to low plastic fines, (LL=19%, PI=5), 1% gravel to 3/8-inch diameter, very loose to loose, noncemented
5. **SILTY GRAVELLY SAND (SM-SC), reddish brown, damp, 70% fine to medium (some coarse) angular to subrounded sand, 21% fine to coarse subrounded to rounded gravel to 3-inch diameter, 9% nonplastic fines, firm to dense, slightly to moderately cemented, moderately iron oxide stained
6. **CLAYEY SAND (SC), light olive-brown, damp, 55% very fine to medium angular to subrounded sand, 45% medium plastic fines, firm, noncemented, slightly iron oxide stained

4F-23 (N 62° E)



1. **SILTY SAND (SM), brown, damp to moist, 70% very fine to fine (some medium) subangular to subrounded sand, 30% low plastic fines, loose, noncemented, organic material includes roots and rootlets
2. *SILTY SAND (SM), gray, MC=19.5%, 69% fine subangular to subrounded sand, 31% low plastic fines, loose to firm, noncemented, some orgsnic materials (rootlets)
3. SILTY GRAVELLY SAND (SM), gray, wet to saturated, est. 60-65% fine to coarse subangular to subrounded sand, est. 25-30% well rounded gravel to 2-1/2-inch diameter, est. 10% low plastic fines, loose to firm, noncemented, some organic material. (F)
4. **SANDY CLAY (CL), yellowish brown, damp, 60% medium plastic fines, 40% medium grained subangular to subrounded sand, firm to stiff, noncemented, some organic material



LOCATION OF EXPLORATION

GRAPHIC SCALE

1 inch = 200 Feet 0' 200' 400' 600' 800' 1000'

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material is larger than No. 200 sieve.	GRAVELS More than half of coarse fraction is larger than No. 4 sieve.	Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% of material is smaller than No. 200 sieve.	SILTS AND CLAYS	Liquid limit below 50%	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or silts. Plasticity below "A" line.
			CL	Inorganic clays, gravelly clays, sandy clays, lean clays. Plasticity above "A" line.
			OL	Organic silts and organic clays. Plasticity below "A" line.
		Liquid Limit 50% and above	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. Plasticity below "A" line.
			CH	Inorganic fat clays. Plasticity above "A" line
			OH	Organic clays or organic silts. Plasticity below "A" line.
Highly organic soils			Pt	Peat, organic content greater than 50%.

LEGEND:

—	Location of Exploration:
GR	Gravel, percent by weight passing 3-inch sieve and retained on the No. 4 sieve.
SA	Sands, percent by weight passing the No. 4 sieve and retained on the No. 200 sieve.
FI	Fines, percent by weight passing the No. 200 sieve.
LL	Liquid Limit.
PI	Plasticity Index (Liquid Limit Minus Plastic Limit).
MC	Field Moisture Content in Percent of Dry Weight.
F	Visual Field Classification.
*	Laboratory Visual Classification.
**	Classification based on laboratory gradation and visual field classification.
FS-1 ⊗	Sack Field Sample or Baggie Field Sample.

NOTES:

1. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487).
2. All sieve sizes on the chart are U.S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, a well-graded gravel-sand mixture with a clay binder.
5. Trenches were excavated with a Case 580C Backhoe.
6. Trenches excavated on 15-21 December 1981.
7. Elevations (El.) estimated from topo maps.

GRAPHIC SCALE

1 inch = 5 Feet 0' 5' 10' 15' 20' 25'

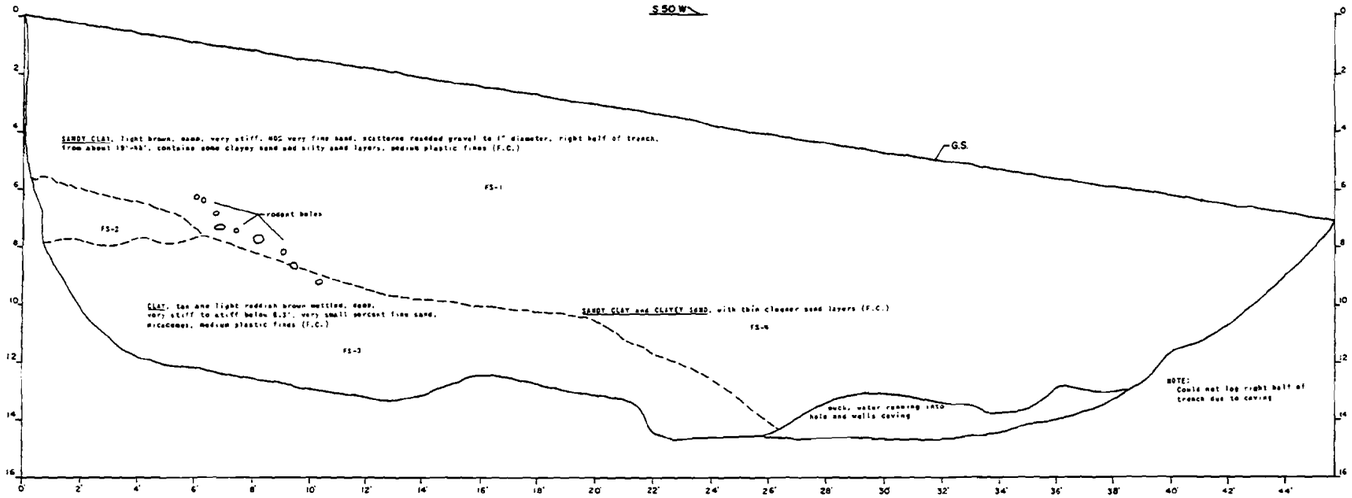
AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY
△				
△				

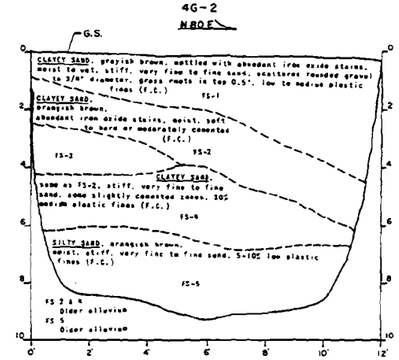
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF TRENCHES
4F-18 thru 4F-23

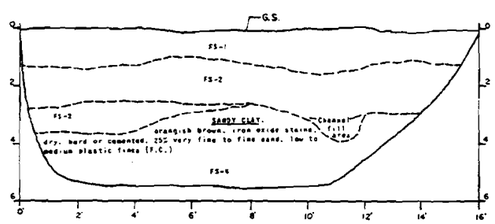
DESIGNED: T. PEARSON
DRAWN: P. LEE, C. BRYANT
CHECKED: D.J. ANDERSON
SUBMITTED: CHIEF, SOIL DESIGN SECTION
DATE APPROVED:
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET No. CG-13
FILE No. 38
ME-12-4-19



FS-2 SANDY CLAY, brown and greenish gray mottled, damp, hard or variably cemented, medium plastic fines (F.C.)



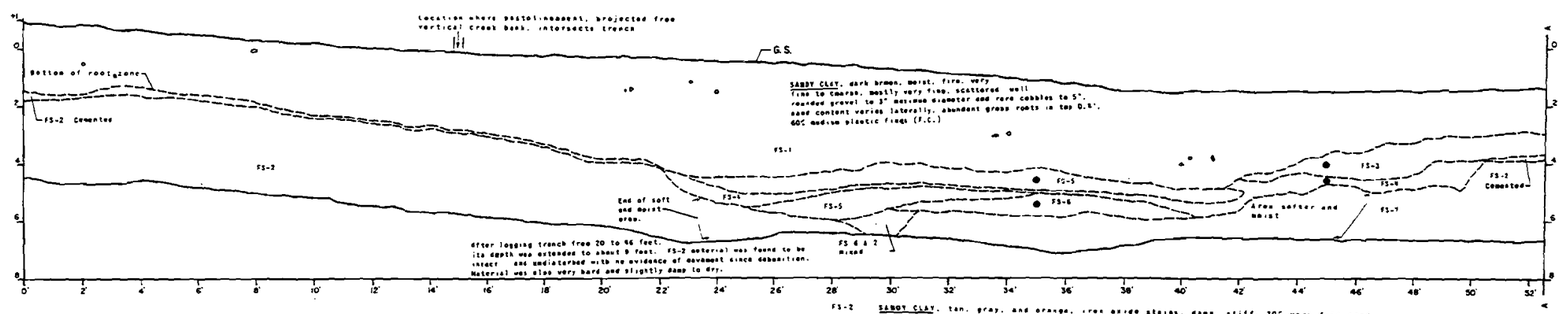
FS-2 SANDY CLAY, brown with iron oxide stains, moist to wet, very soft, 35%-40% very fine to fine sand, scattered rounded gravel to 2" maximum diameter and one cobble to 2.5", low plastic fines (F.C.)



FS-1 CLAYEY SAND, grayish brown, mottled with abundant iron oxide stains, moist, very stiff to slightly cemented, very fine to fine sand, scattered rounded gravel to 1/2" diameter, grass roots in top 0.8', 20% low plastic fines (F.C.)

FS-2 SANDY CLAYEY GRAVEL, brown, damp, hard or slightly cemented, sand very fine to coarse, rounded gravel to 3" maximum diameter, medium plastic fines, coarser material and a 6" cobble in the channel-fill area (F.C.)

FS-3 SANDY CLAY, brown, damp, hard, 20% fine sand, scattered rounded gravel to 3/4" diameter, medium plastic fines (F.C.)



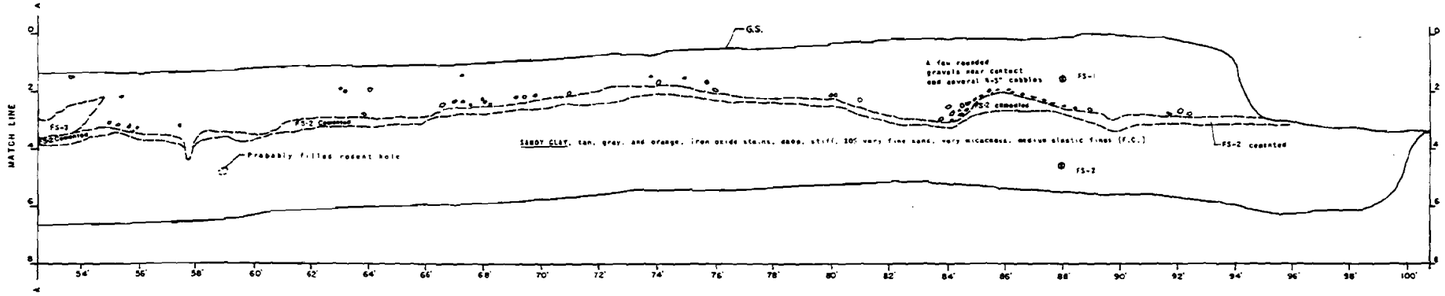
FS-2 SANDY CLAY, tan, gray, and orange, iron oxide stains, damp, stiff, 30% very fine sand, very micaceous, medium plastic fines (F.C.)

FS-3 CLAYEY SAND, brown and gray mottled, damp, firm, very fine to fine sand, 15% medium plastic fines (F.C.)

FS-4 SANDY CLAY, dark grayish brown, moist, firm to soft, scattered inclusions of FS-2 material, very fine sand, 55% medium plastic fines (F.C.)

FS-5 SAND, light tan with brown streaks, damp, loose, fine to coarse sand, mostly medium grained, small percent fines in some layers (F.C.)

FS-6 SANDY GRAVEL, dark grayish tan, moist, firm, well rounded gravel to 3" maximum diameter (F.C.)



GRAPHIC SCALE

1 Inch = 2 Feet

EXPLANATION OF SYMBOLS

— — —	Geologic Contact Between Different Types Of Materials.
G.S.	Original Ground Surface.
FS-1 ⊕	Sack Field Sample or Boggy Field Sample.
(F.C.)	Denotes Field Classification.

All Elevations Are In Feet.

NOTES:

Trenches Were Excavated By A Case 580 B Backhoe In December 1978.

Soils Classification Conform To Military Standard 619 B "UNIFIED SOILS CLASSIFICATION SYSTEM."

Refer To Sheet G-1 For Location Of Trenches.

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R.L. TREAT
DRAWN: D.W. PAIGE
CHECKED: J.B. MOSES

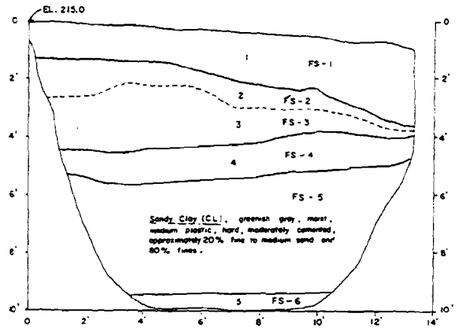
WERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF TRENCHES
4G-1 THRU 4G-4

SUBMITTED: Robert L. Jewett, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87
SCALE: AS SHOWN
DWG. No. 6352A
SHEET CG-14 39
FILE No. ME-12-4-19

4B-1

S 40° E

NOTE Center of trench is 136' right of of spillway ℄ sta. 17+00.

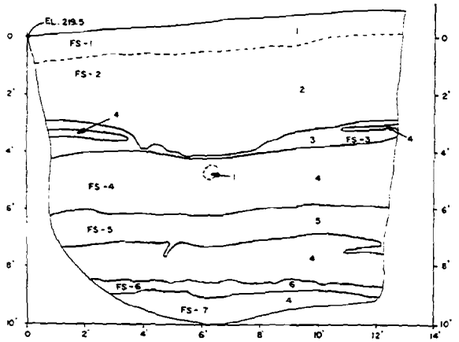


1. **Sandy Clay (SC), dark brown, moist, medium plastic stiff, approximately 15% very fine sand, abundant grass roots to 6".
2. **Silt (ML), greenish gray, damp, non plastic, hard, moderately fractured, fractures coated with calcite & iron-oxide, few thin cemented sand (SM) layers.
3. Silt (ML), greenish gray with abundant iron-oxide stains, 25% moisture, medium plasticity, (LL=40, PI=9), hard, 2% sand, 98% fines.
4. *Silty Sand (SM), light gray with streaks of medium-brown, damp, very firm, approximately 75% very fine sand and 25% silt.
5. Sandy Silt (ML), light gray with some iron-oxide stains, damp, slightly elastic (LL=31, PI=5) very firm. 12% sand, 88% fines.

4B-2

S 25° W

NOTE: Sta. 12+00 88ft. left of spillway ℄.

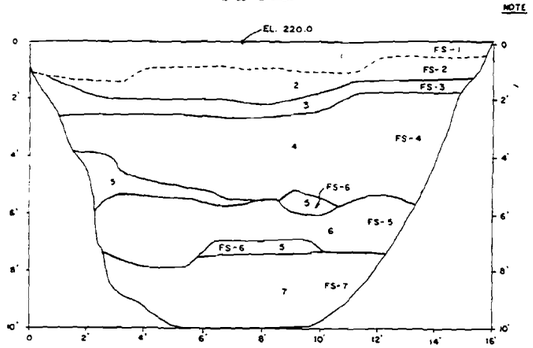


1. **Sandy Clay (CL), dark brown, moist, medium plastic, firm, grass roots top 3", scattered, well rounded gravel to 2", approximately 40% very fine sand and 60% fines.
2. Sandy Clay (CL), dark reddish brown, very damp, slight to medium plasticity (LL=26, PI=14), stiff to slightly cemented, 1% well rounded gravel to 2", 42% fine to medium sand, 57% fines.
3. **Silty Sand (SM), reddish brown & gray (streaked), damp, micaceous, very firm, some streaks of medium grained sand, approximately 20% silt & 80% very fine to fine sand.
4. **Clay (CL), greenish gray, disseminated iron-oxide stains, damp, medium to high plasticity, stiff.
5. *Silty Sand (SM), light gray to brown, damp, micaceous, firm to very firm, 11% silt & 89% fine to medium sand.
6. **Silty Sand (SM), tan to gray, damp, micaceous, firm, approximately 15% silt, 85% very fine sand.

4B-3

N 68° E

NOTE Sta 10+60 95' right of spillway ℄.

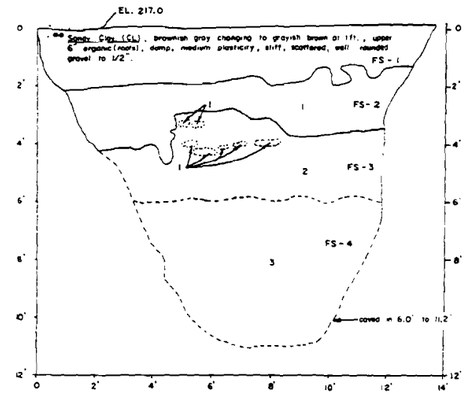


1. **Sandy Clay (CL), dark gray, damp, medium to high plasticity, firm, scattered rounded gravels to 2", roots to 5", approximately 20% very fine sand.
2. Sandy Clay (CL), dark grayish brown, slightly damp, medium plasticity (LL=38, PI=24), very stiff, 34% very fine sand, 66% fines.
3. **Gravelly Sandy Silt (ML), dark reddish brown, with some iron-oxide stains, moderately soft, slightly cemented, approximately 10% rounded gravel to 2", 35% fine to medium sand, 55% silt.
4. **Silty Sand (SM), reddish brown, mottled with gray, slightly damp, non plastic, very stiff, 83% sand, 17% fines.
5. **Clay (CL), grayish brown with some iron-oxide stains, slightly damp, slightly plastic, very stiff, approximately 10% very fine sand.
6. **Silty Sand (SM), reddish brown with some iron oxide stains, slightly damp, stiff to very stiff, approximately 15% silt, 85% fine micaceous sand.
7. Sandy Silt (ML), gray with some iron oxide stains, damp, slightly elastic (LL=34, PI=7), stiff, 14% fine sand, 86% silt.

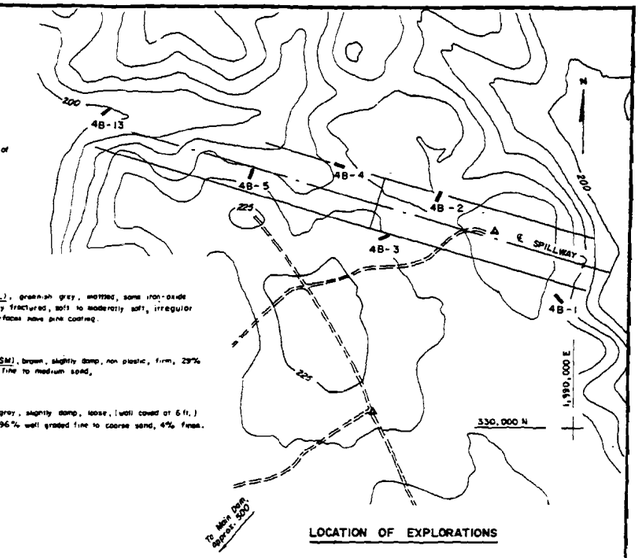
4B-4

S 70° E

NOTE Sta. 8+40 95' left of spillway ℄.



1. **Sandy Clay (CL), brownish gray changing to grayish brown at 1ft., upper 6" organic (roots), damp, medium plasticity, stiff, scattered, well rounded gravel to 1/2".
1. **Siltstone (ML), greenish gray, mottled, some iron-oxide stains, highly fractured, soft to moderately soft, irregular fractured surfaces have pale coating.
2. *Silty Sand (SM), brown, slightly damp, non plastic, firm, 29% silt, 71% fine to medium sand.
3. *Sand (SW), gray, slightly damp, loose, (well caved at 6 ft.) micaceous, 96% well graded fine to coarse sand, 4% fines.



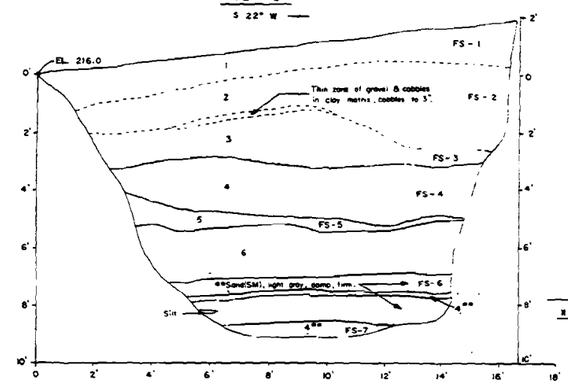
LOCATION OF EXPLORATIONS

1 Inch = 200 Feet 0' 200' 400' 600' 800' 1000'

4B-5

S 22° W

NOTE Center of trench 20' rt of spillway ℄ sta. 5+62.

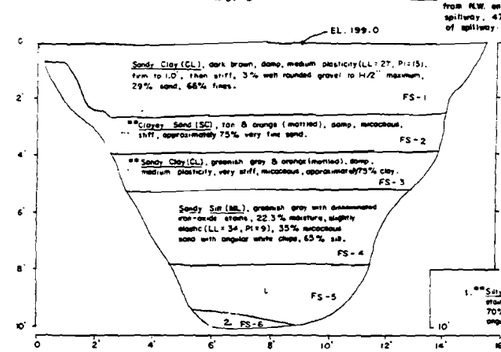


1. **Clayey Sand (SC), dark brown, organic (roots), moist, slightly plastic, firm, rare well-rounded gravel to 1/2", approximately 60% very fine to fine sand, 40% clay.
2. *Clayey Sand (SC), brown, damp, slightly plastic (LL=21, PI=8), firm, 57% sand, 43% fines.
3. **Silty Sand (SM), light reddish brown, damp, very firm, approximately 20% silt, 80% fine sand.
4. Silt (ML), greenish gray with disseminated iron-oxide stains, 26.4% moisture, slightly elastic (LL=34, PI=8), very stiff, moderately cemented, 3% very fine sand, 97% silt.
5. **Silt (SM), light gray with greenish gray stringers, dry, firm, approximately 90% fine sand.
6. **Silt (ML), greenish gray, damp, slightly elastic, very stiff, approximately 5% very fine sand, 95% fines.

4B-13

N 5° E

NOTE: Trench located 22' from R.W. end of spillway, 47' left of spillway.



1. **Silty Sand (SM), light gray with some iron-oxide stains, moist, non-plastic, firm, approximately 70% fine to coarse micaceous sand with white angular chips, 30% fines.
2. Sandy Silt (ML), light brown and orange, (mottled) with iron-oxide stains, moist, slightly elastic (LL=28, PI=5), stiff, cemented, 31% fine sand, 69% fines.

NOTES:

1. For Legend and Unified Soil Classification System chart, see sheet C-14.
2. Classifications are in accordance with the Unified Soils Classification System (ASTM D-2487)
3. All Sieve sizes on the chart are U.S. Standard.
4. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus No. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (ASTM D-2487) and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
5. Borderline Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GM-GC, a well-graded gravel-sand mixture with a clay binder.
6. Elevations refer to National Geodetic Vertical Datum of 1929.
7. Grid Coordinates are Calif. Coordinate System.

GRAPHIC SCALES

0 1' 2' 4' 6' 8' 10'

1 Inch = 2 Feet

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

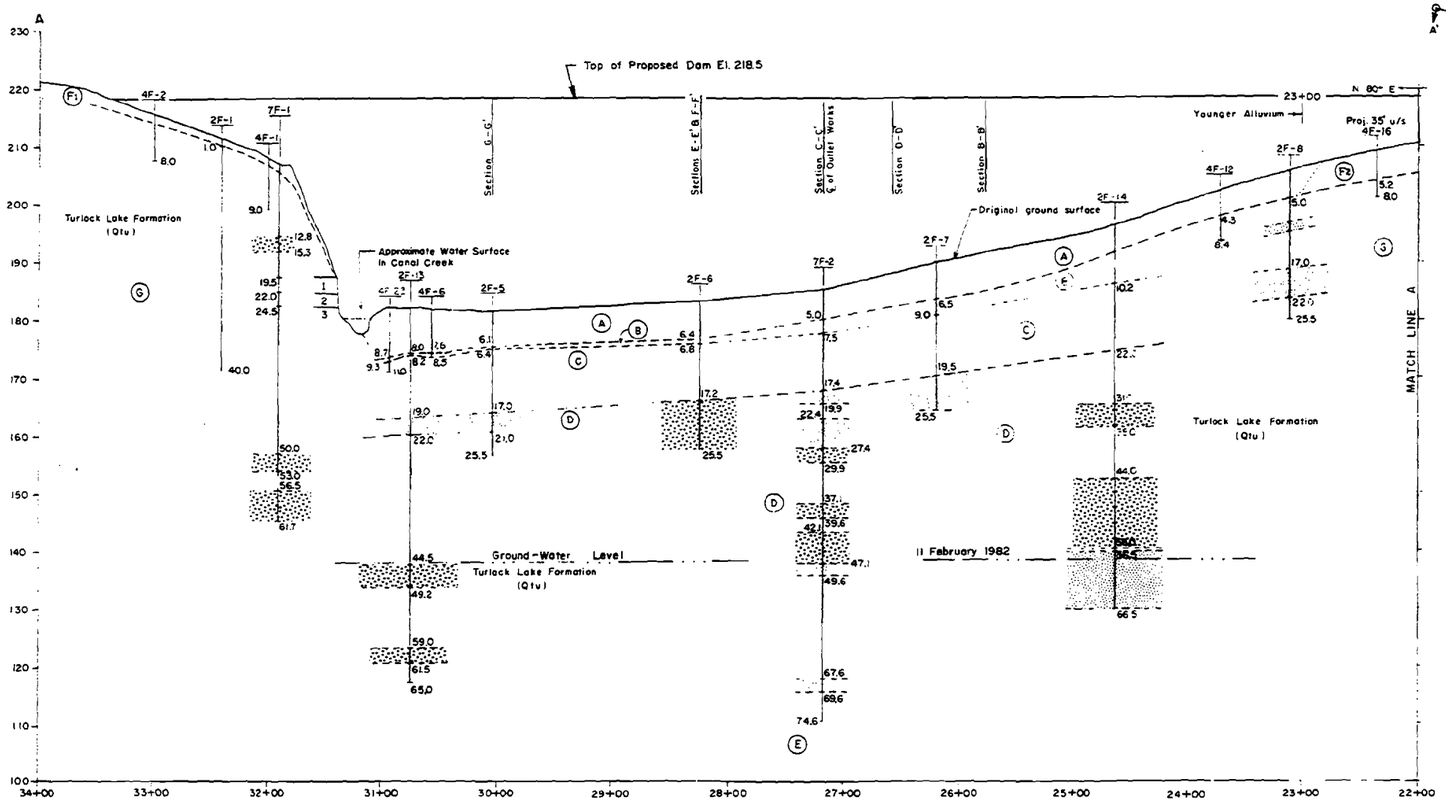
DESIGNED: T. J. S., R. L. T.
DRAWN: R. L. T.
CHECKED: R. L. TREAT
SUPERVISED: Robert L. Treat, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87

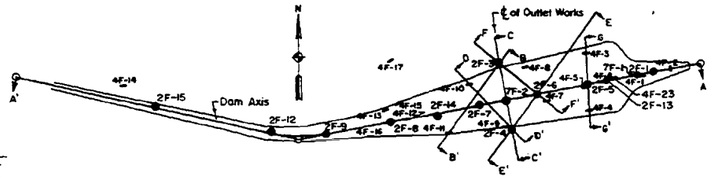
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA

CASTLE DAM AND RESERVOIR

LOGS OF TRENCHES-SPILLWAY AREA
4B-1 THRU 4B-5 AND 4B-13

SCALE: AS SHOWN
SHEET CG-15 OF 40
FILE NO. ME-12-4-19





LOCATION OF SECTIONS AND EXPLORATIONS

0 100' 200' 400' 600' 800' 1000'

1 inch = 200 Feet

EXPLANATION

VALLEY BOTTOM

YOUNGER ALLUVIUM

(A) Silty sand, clayey sand, sand, sandy silt, and sandy clay; light to dark brown, some light reddish brown and tan; loose to firm or stiff, parts variably cemented; scattered well rounded gravel to about 2 inches in diameter; varies from about 4.3 to 9.0 feet thick; layers contain from about 10 to 83 percent non to low plastic fines; westward from Sta. 25+00± the unit is partly interfingered with, and overlain by, slopewash derived from the Turlock Lake Formation, and the top 3.5 to 4.5 feet has been disturbed by agricultural ripping operations.

(B) Clayey sand, silty sand, clayey gravelly sand, gravelly clayey sand, gravelly sand, and sandy gravel; light reddish brown to brown; consists primarily of clayey sand with scattered to abundant well rounded gravel and small cobbles; dense to stiff; varies from about 0.3 to over 3.5 feet in thickness; sand is fine to coarse grained, mostly medium to coarse; contains less than 5 to 30 percent low to medium plastic fines, micaceous.

OLDER ALLUVIUM

(C) Sandy clay, sandy silt, silty sand, clayey sand, gravelly sandy silt; greenish gray, brownish gray and tan to brown with variable iron oxide staining; firm to very stiff or slightly cemented; parts are pumiceous; varies from about 3.5 to over 12.0 feet in thickness; contains about 20 to 99 percent nonplastic to medium plastic fines, micaceous.

(D) Silty sand, sand, clayey sand, sandy clay and sandy silt, light brown, brown, and brownish gray, with variable iron oxide staining, firm to hard or cemented, predominantly silty sand layers with 4 to 49 percent nonplastic fines, few clean sand layers about 2.5 to over 8.3 feet thick (4-14 percent fines), one 2.5-foot thick sandy silt layer at 59.6 feet in drill hole 7F-2 and one sandy silt-sandy clay layer 4.5± feet thick in the bottom of drill hole 2F-5. Unit contains some clayey sand with 11-42 percent low plastic fines, micaceous throughout.

(E) Gravelly sandy clay and sandy clay, beige mottled with iron oxide stains, soft, containing up to 73 percent low plastic fines. ±5 percent gravel to 3-inches maximum diameter from 69.6 to 72.1 feet, the depth of this unit could not be determined because drill hole 7F-2 bottomed at 74.6 feet in this unit, the bottom 2.5 feet is sandy clay that appears to be sheared and contains numerous glossy slickensided surfaces.

ABUTMENTS

(F1) Clayey sand, sandy clay (slopewash), dark brown, soft to stiff; sand is fine to medium grained; contains 40 to 60 percent low to medium plastic fines, micaceous; varies from 0.5 to 1.5 feet in thickness; material is derived from soil formed on the underlying Turlock Lake Formation.

(F2) Sandy clay, clayey sand, silty sand, sandy silt, and sand (mixed soil developed from the underlying Turlock Lake Formation and top 3.5 to 4.5 feet of material disturbed by ripping operations); light gray, brown, and tan; firm to stiff and parts variably cemented; layers contain from about 35 to 100 percent low to medium plastic fines, micaceous.

(G) Sandy clay, silt, clayey sand, sandy silt, silty sand, clay and sand, light brown, brownish gray, grayish tan and greenish gray, variably iron oxide stained, firm to very stiff and some slightly to moderately cemented layers, layers are predominantly fine grained with most containing 20 to 85 percent low to medium plastic fines, micaceous throughout, contains a 1.5 to 2.5 foot thick pumiceous layer at elevation 190 feet in the right abutment (Sta 21+00 to 23+00) and a similar layer at elevation 197 feet in the spillway sill foundation. Pervious sand layers containing variable amounts of fines occur at scattered locations. In the left abutment, pervious sands were penetrated by drill hole 7F-1 at 12.8 to 15.3 feet, 50.0 to 53.0 feet, and from 56.5 feet to the bottom of the hole at 61.7 feet. In the right abutment, pervious sands were encountered from 19.5 to 23.0 feet in hole 2F-9. These layers are very similar to the cleaner sands penetrated in the valley bottom (Unit D) in drill hole 7F-2.

1 2 3 — Location of samples for clay mineral analysis.

2F-9 — Location of drill holes in the section.

6F-13 — Location of trenches on location map.

Geologic contact.

A A' — Plane of Geologic Section.

Fairly clean sand layers containing approximately 4-12 percent fines.

Silty sand layers containing approximately 12-25 percent fines (not delineated in units (A), (B), and (C)).

NOTES:

a. The center of each trench location is shown as a single line to present data on the geologic section.

b. The delineation of subsurface units as shown on this section, is based on a combination of exploration and laboratory data.

c. All elevations are in feet, 1929 sea level datum.

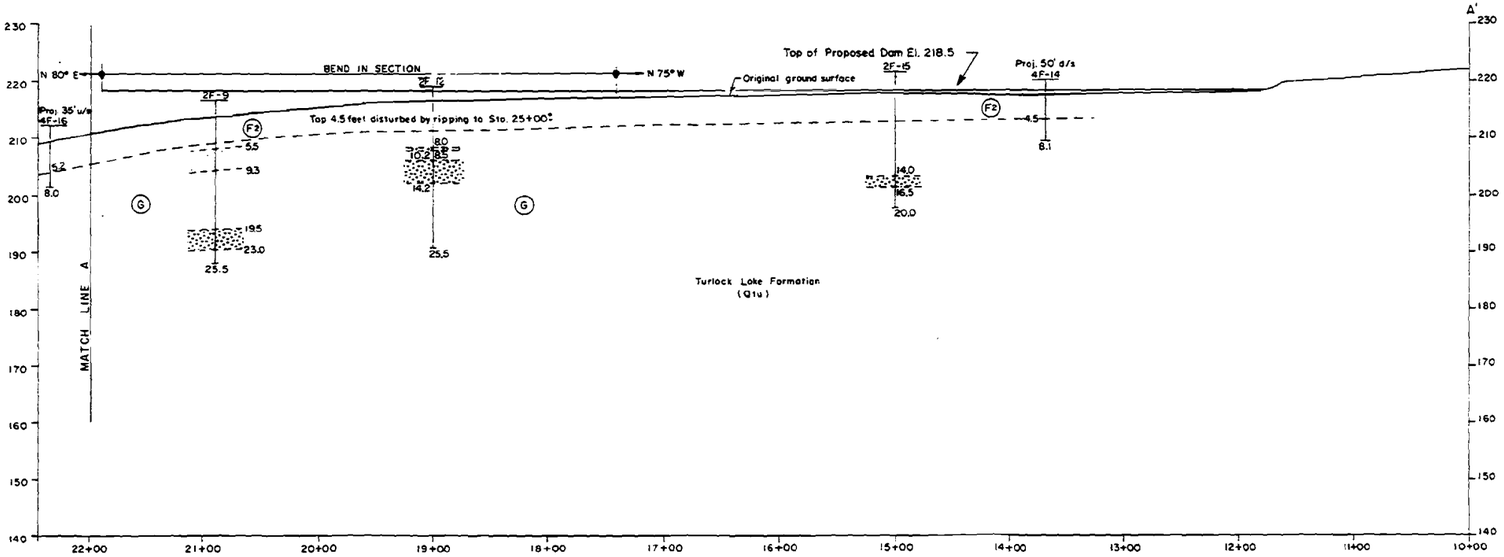
d. Drill hole and trench logs are shown on Sheets CG-5 to CG-15

e. Unit G in the abutments is similar to C, D, and E only drill hole data is from higher elevations within the Turlock Lake Formation and materials are not grouped into units.

GRAPHIC SCALES

HORIZONTAL SCALE 1 inch = 50 Feet: 0' 50' 100' 150' 200' 250'

VERTICAL SCALE 1 inch = 10 Feet: 0' 5' 10' 20' 30' 40' 50'



GEOLOGIC SECTION A-A' ON DAM AXIS

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

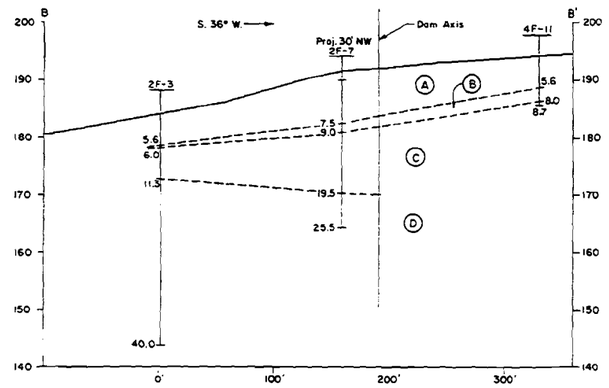
DESIGNED: R.L. TREAT
DRAWN: F. BOROWSKI
CHECKED: J.B. MOSES
SUBMITTED: CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
GEOLOGIC SECTION A-A' ON DAM AXIS

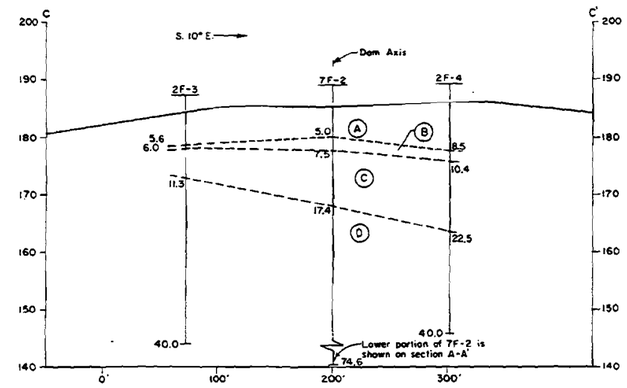
SCALE: AS SHOWN | SPEC. No. 6352-
SHEET CG-16 41 | FILE No. ME-12-4-19

SAFETY PAYS

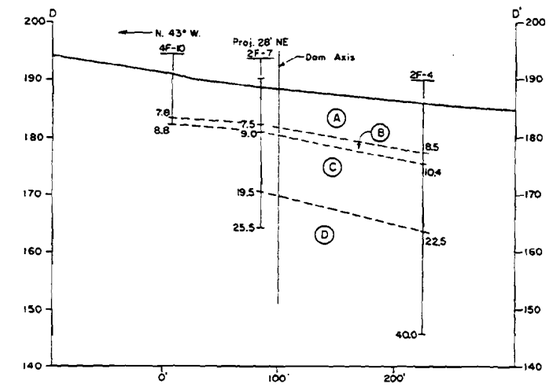
PLATE 44



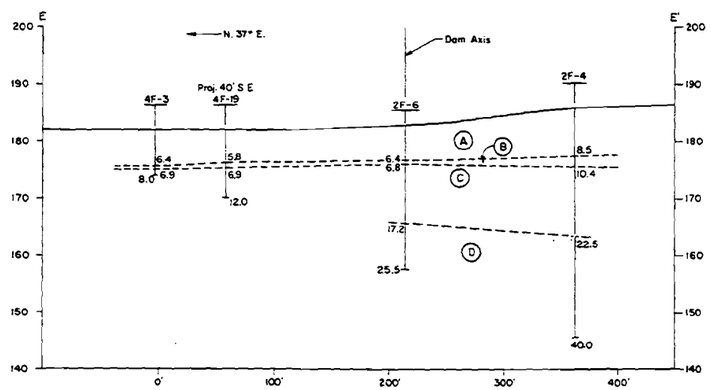
SECTION B-B'



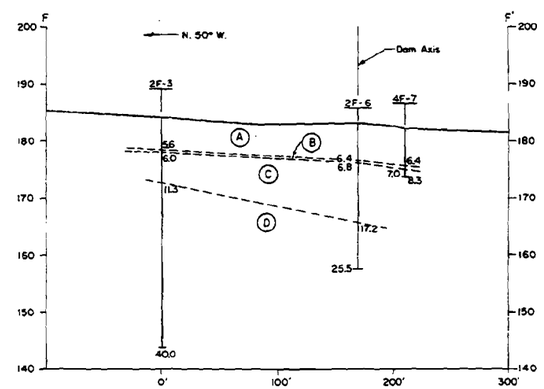
SECTION C-C'
ON ℄ OF OUTLET WORKS Sta. 27+17



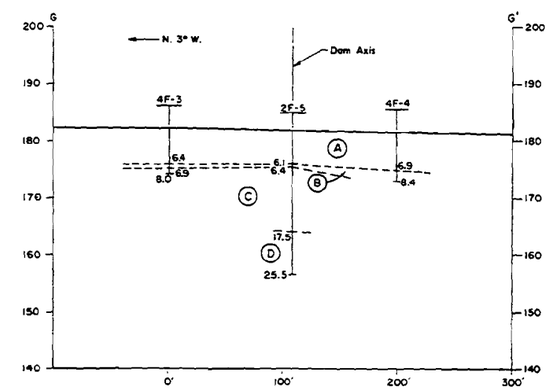
SECTION D-D'



SECTION E-E'



SECTION F-F'



SECTION G-G'

EXPLANATION

VALLEY BOTTOM

YOUNGER ALLUVIUM

(A) Silty sand, clayey sand, sand, sandy silt, and sandy clay: light to dark brown, some light reddish brown and tan; loose to firm or stiff, parts variably cemented; scattered well rounded gravel to about 2 inches in diameter; varies from about 4.3 to 9.0 feet thick layers contain from about 10 to 85 percent non to low plastic fines; westward from Sta. 25+00± the unit is partly interfingered with, and overlain by, slopewash derived from the Turlock Lake Formation, and the top 3.5 to 4.5 feet has been disturbed by agricultural ripping operations.

(B) Clayey sand, silty sand, clayey gravelly sand, gravelly clayey sand, gravelly sand, and sandy gravel; light reddish brown to brown; consists primarily of clayey sand with scattered to abundant well rounded gravel and small cobbles; dense to stiff; varies from about 0.3 to over 3.5 feet in thickness; sand is fine to coarse grained, mostly medium to coarse; contains less than 5 to 30 percent low to medium plastic fines, micaceous.

OLDER ALLUVIUM

(C) Sandy clay, sandy silt, silty sand, clayey sand, gravelly sandy silt; greenish gray, brownish gray and tan to brown with variable iron oxide staining; firm to very stiff or slightly cemented; parts are pumiceous; varies from about 3.5 to over 12.0 feet in thickness; contains about 20 to 99 percent nonplastic to medium plastic fines, micaceous.

(D) Silty sand, sand, clayey sand, sandy clay and sandy silt, light brown, brown, and brownish gray, with variable iron oxide staining; firm to hard or cemented, predominantly silty sand layers with 9 to 49 percent nonplastic fines, few clean sand layers about 2.5 to over 8.3 feet thick (4-14 percent fines), one 2.5 foot-thick sandy silt layer at 39.6 feet in drill hole 7F-2 and one sandy silt-sandy clay layer 4.5± feet thick in the bottom of drill hole 2F-5. Unit contains some clayey sand with 11-42 percent low plastic fines, micaceous throughout.

(E) Gravelly sandy clay and sandy clay, beige mottled with iron oxide stains, soft, containing up to 73 percent low plastic fines, 55 percent gravel to 3 inches in diameter from 69.6 to 72.1 feet, the depth of this unit could not be determined because drill hole 7F-2 bottomed at 74.6 feet in this unit, the bottom 2.5 feet is sandy clay that appears to be sheared and contains numerous glossy slickensided surfaces.

ABUTMENTS

(F1) Clayey sand, sandy clay (slopewash), dark brown, soft to stiff; sand is fine to medium grained; contains 40 to 60 percent low to medium plastic fines, micaceous; varies from 0.5 to 1.5 feet in thickness; material is derived from soil formed on the underlying Turlock Lake Formation.

(F2) Sandy clay, clayey sand, silty sand, sandy silt, and sand (mixed soil developed from the underlying Turlock Lake Formation and top 3.5 to 4.5 feet of material disturbed by ripping operations); 35 to 100 percent low to medium plastic fines, micaceous.

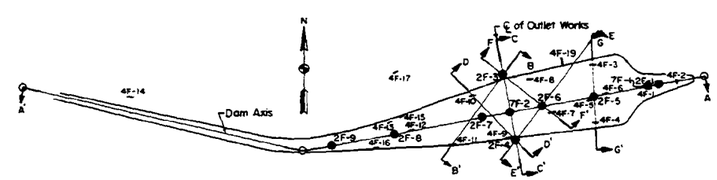
(G) Sandy clay, silt, clayey sand, sandy silt, silty sand, clay and sand, light brown, brownish gray, grayish tan and greenish gray, variably iron oxide stained, firm to very stiff and some slightly to moderately cemented layers, layers are predominantly fine grained with most containing 20 to 85 percent low to medium plastic fines, micaceous throughout, contains a 1.5 to 2.5 foot thick pumiceous layer at elevation 190 feet in the right abutment (Sta. 21+00 to 23+00) and a similar layer at elevation 197 feet in the spillway sill foundation. Pervious sand layers containing variable amounts of fines occur at scattered locations. In the left abutment, pervious sands were penetrated by drill hole 7F-1 at 12.8 to 15.3 feet, 50.0 to 53.0 feet, and from 56.5 feet to the bottom of the hole at 61.7 feet. In the right abutment, pervious sands were encountered from 19.5 to 23.0 feet in 2F-9. These layers are very similar to the cleaner sands penetrated in the valley bottom (Unit D) in drill hole 7F-2.

2F-9 Location of drill holes in the section and location map.

4F-13 Location of trenches on location map and sections.

Geologic contact.

B B' Place of Geologic Section.



LOCATION OF SECTIONS AND EXPLORATIONS

0 100' 200' 400' 600' 800' 1000'
1 inch = 200 Feet

NOTES

a. The center of each trench location is shown as a single line to present data on the geologic section

b. All elevations in feet, refer to sea level datum of 1929

c. Refer to Sheets C6-3 to C6-10 for drill logs and to Sheets C6-11 to C6-16 for trench logs

d. See note d. on Sheet C-17

GRAPHIC SCALES

HORIZONTAL SCALE 1 inch = 50 Feet: 0 10' 25' 50' 100' 150' 200' 250'

VERTICAL SCALE 1 inch = 10 Feet: 0 5' 10' 20' 30' 40' 50'

AS-CONSTRUCTED

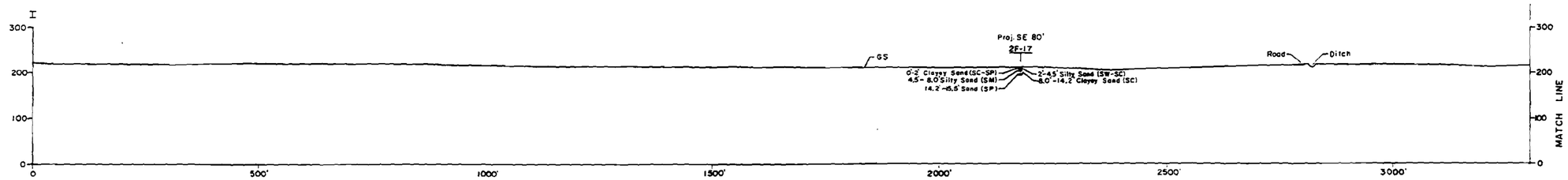
REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

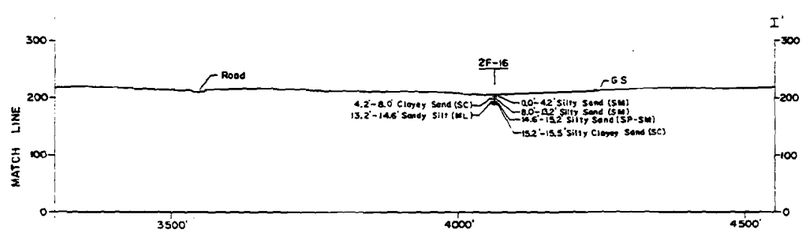
DESIGNED: R. L. Treat
DRAWN: F. Borowski
CHECKED: R. L. Treat
SUBMITTED: Robert L. Street, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 Mar 87

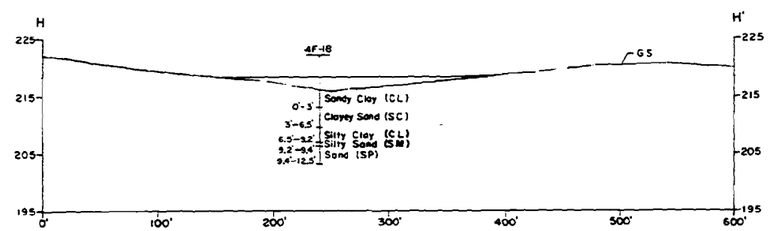
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
GEOLOGIC SECTIONS MAIN DAM
B-B' THRU G-G'

SCALE: AS SHOWN
SPEC. No. 6352-A
SHEET CG-17 OF 42
FILE No. ME-12-4-19



GEOLOGIC SECTION I-I' ON AXIS OF DIKE A





GEOLOGIC SECTION H-H' NEAR AXIS OF DIKE B

GRAPHIC SCALE

Scale in feet 0' 100 200 300 400 500

1 Inch = 100 Feet

GRAPHIC SCALES

Vertical scale in feet 0' 10' 20' 30' 40' 50'

1 Inch = 10 Feet

Horizontal scale in feet 0' 50' 100' 150' 200' 250'

1 Inch = 50 Feet

NOTES:

a. Refer to Sheet CG-1 for location of sections

b. Refer to Sheet CG-3 for drill holes location and logs

c. All elevations are in feet, 1929 sea level datum

d. GS Original ground surface

e. The center of each trench location is shown as a single line to present data on the geologic section

f. Trench log 4F-18 shown on Sheet CG-15

AS-CONSTRUCTED

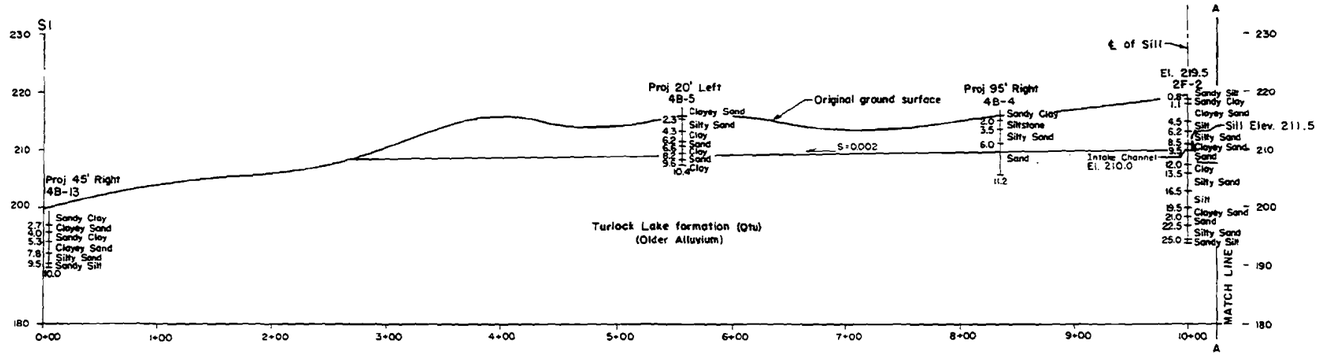
REVISION	DATE	DESCRIPTION	BY	BY

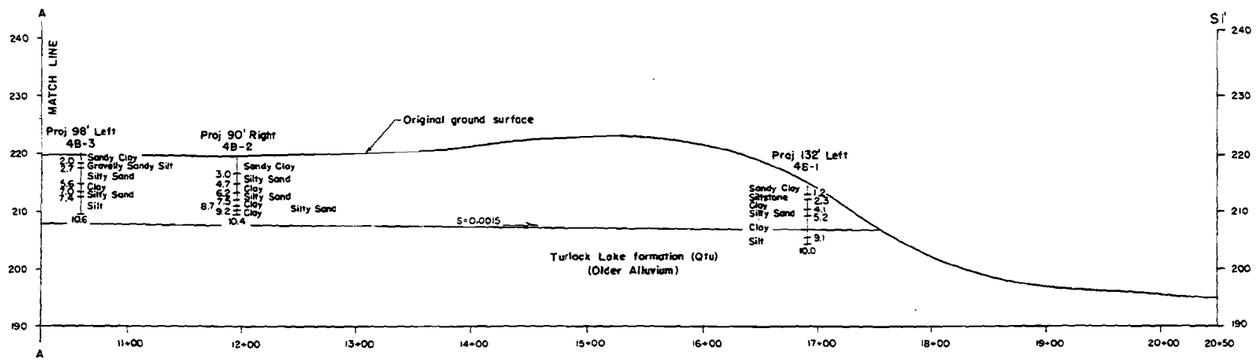
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R.L. Treat
DRAWN: D.W. Paige
CHECKED: R.L. Treat

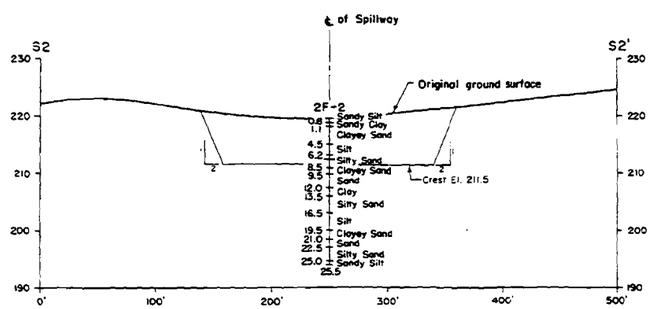
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
GEOLOGIC SECTIONS H-H' DIKE B AND I-I' DIKE A

SUBMITTED: Robert L. Smart, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87
SCALE: AS SHOWN
VPR. No. 6352A
SHEET CG-18 43
FILE No. ME-12-4-19





GEOLOGIC SECTION S1-S1' ON ℄ OF SPILLWAY



GEOLOGIC SECTION S2-S2' SILL

NOTES:

1. All geologic materials are part of the Turlock Lake formation or Older Alluvium. Refer to the Areal Geology and Explorations Sheet (CG-1) and Geologic Section A-A' for a general description (shown on Sheet CG-16)
2. Refer to Areal Geology and Explorations for location of sections.
3. All elevations are in feet. National Geodetic Vertical Datum of 1929.

EXPLANATION OF SYMBOLS

4B-5 Trench projected to section. Logs shown on Sheet CG-15

2F-2 Auger hole location. Log shown on Sheet CG-3

GRAPHIC SCALES

HORIZONTAL SCALE 1 inch = 50 Feet

VERTICAL SCALE 1 inch = 10 Feet

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

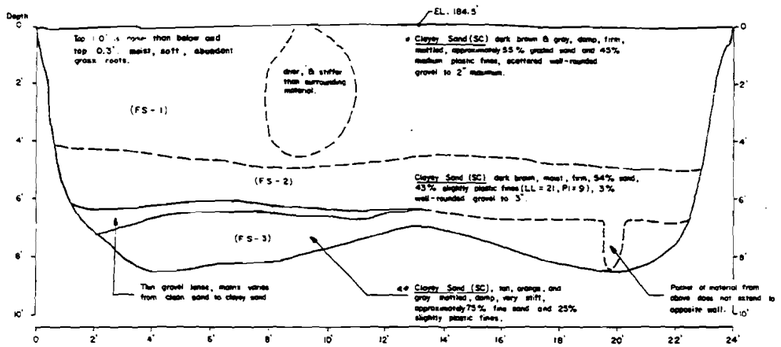
DESIGNED: R. L. Treat
DRAWN: E.R. Echeverria
CHECKED: R L Treat
SUBMITTED: Robert L. Smith, CHIEF, GEOLOGY SECTION
DATE APPROVED: 27 May 87

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
SPILLWAY
GEOLOGIC SECTIONS S1-S1' AND S2-S2'

SCALE: AS SHOWN | SPEC. No. 6352A
SHEET CG-19 44 | FILE No. ME-12-4-19

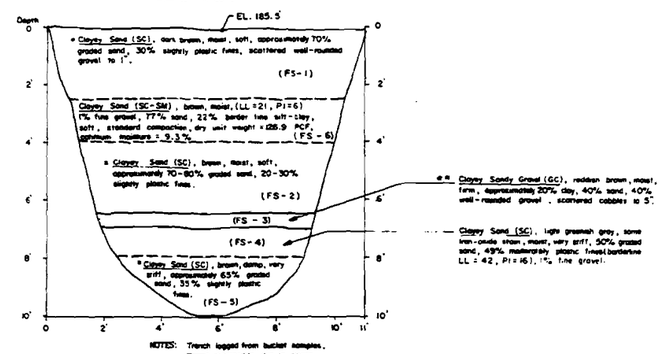
4B - 6

BEARING N. 29° E



4B - 9

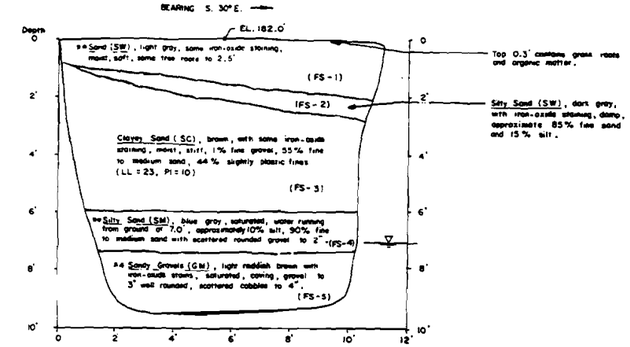
BEARING N. 60° E.



NOTES: Trench logged from bucket samples. Trench inaccessible due to caving. 100 lb. sample (FS-6) taken from 3.0' to 4.0'.

4B - 12

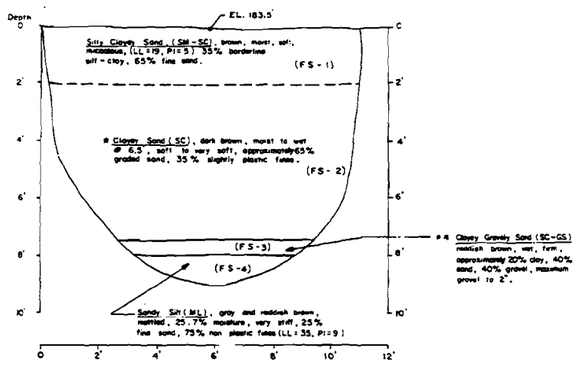
BEARING S. 30° E.



NOTES: Encountered ground water at 7.0'. Sand layer 0.0' to 1.7'; thickness increases as it approaches downstream end of trench.

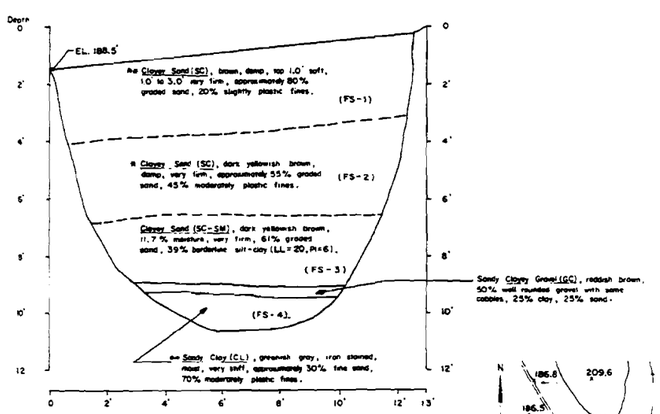
4B - 7

BEARING S. 62° W



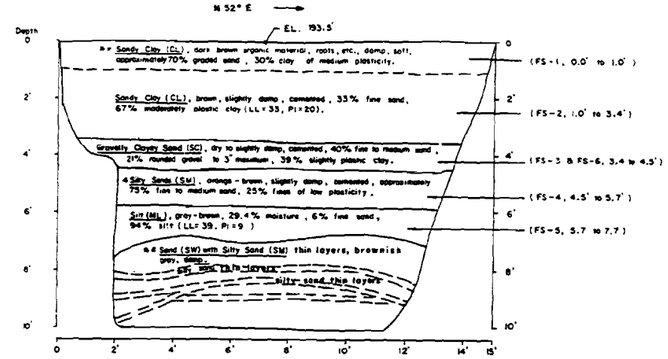
4B - 10

BEARING N. 62° E



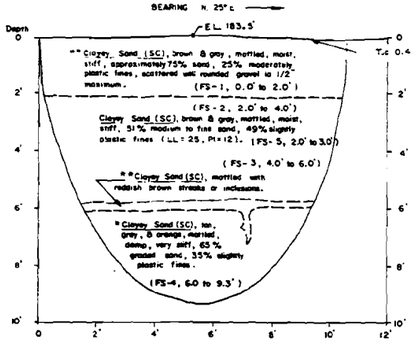
4B - 14

N 52° E



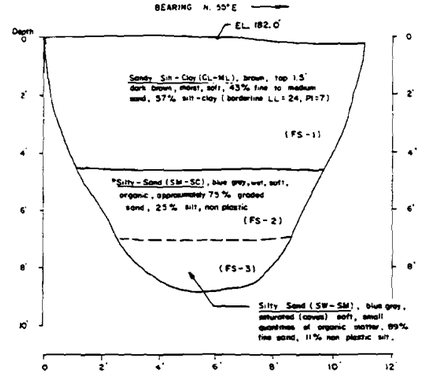
4B - 8

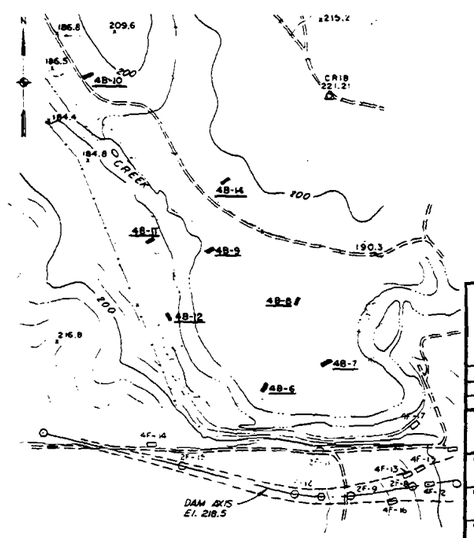
BEARING N. 25° E



4B - 11

BEARING N. 50° E





LOCATION OF EXPLORATIONS

0' 200' 400' 600' 800' 1,000'
1 inch = 200 feet

LEGEND:

- * LABORATORY VISUAL CLASSIFICATION
- ** FIELD VISUAL CLASSIFICATION
- GRADATIONAL CONTACT
- DISTINCT CONTACT
- WATER LEVEL

NOTE:

EXCAVATED WITH CASE BACKHOE 14, DEC. 78 TO 20, DEC. 78.

GRAPHIC SCALE

0' 2' 4' 6' 8' 10'
1 inch = 2 Feet

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY
1	9 JUNE 78	CORRECT TITLE BLOCK		

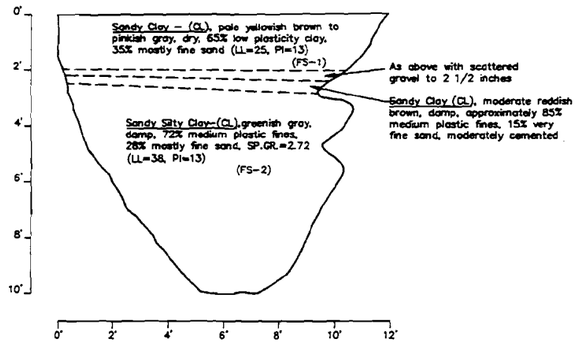
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: D. J. A.
DRAWN: C. E. R.
CHECKED: D. R.

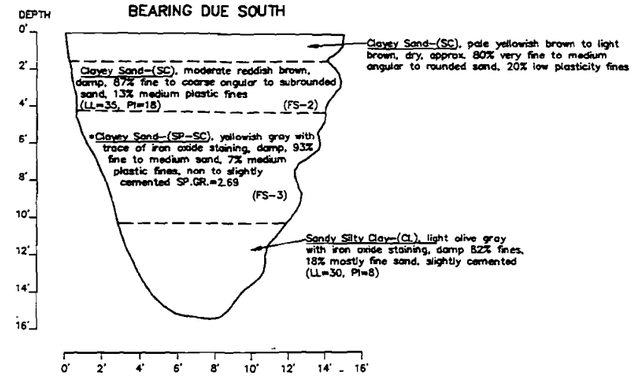
MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
⚠ LOGS OF TRENCHES
REQUIRED BORROW AREA
4B-6 THRU 4B-12 AND 4B-14

SUBMITTED: CHIEF, ENG. GEOL. SECTION
DATE APPROVED:
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET CG-20 OF 45
FILE No. ME-12-4-19

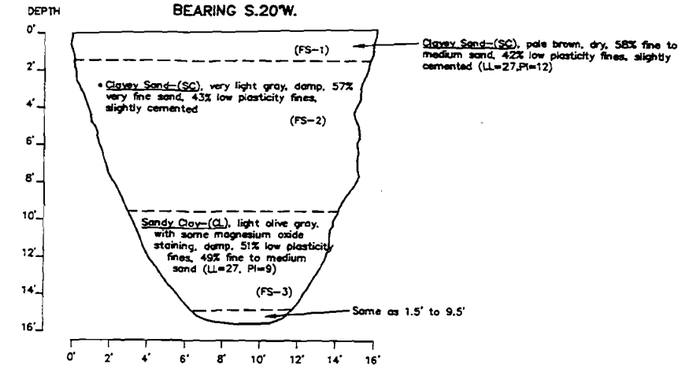
4B–15
BEARING S.60°E.



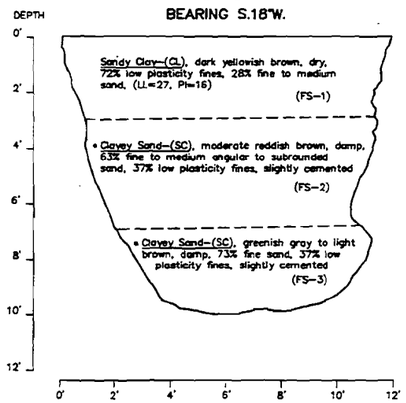
4B–16
BEARING DUE SOUTH



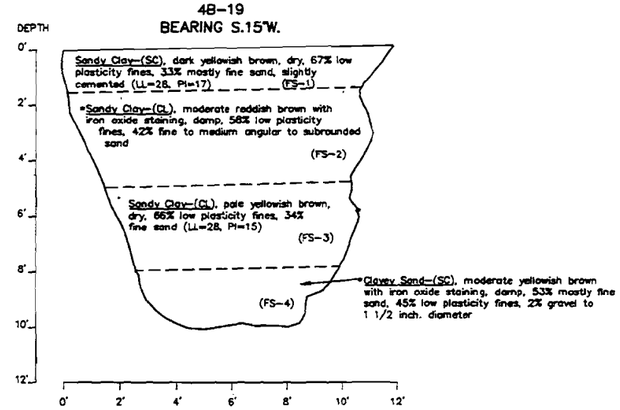
4B–17
BEARING S.20°W.



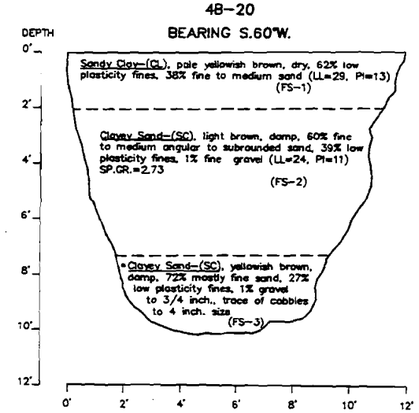
4B–18
BEARING S.18°W.



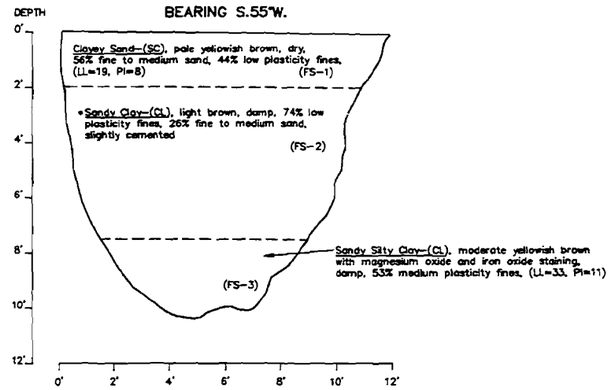
4B–19
BEARING S.15°W.



4B–20
BEARING S.60°W.



4B–21
BEARING S.55°W.



GRAPHIC SCALE

1"=2' 0' 2' 4' 6' 8' 10'

1"=3' 0' 3' 6' 9' 12' 15'

NOTES:

1. Trenches were excavated on 14 October 1987 by Brad Watson Backhoe of Modesto, California. Trenches were excavated with a Case 580C equipped with a 24" wide bucket
2. Sample classifications denoted with an asterisk (*) are classified based on laboratory gradation and field descriptions utilizing the Unified Soil Classification System.
   All other soil samples were fully classified under the Unified Soil Classification System based on laboratory gradation and Atterberg limits test results.
3. See plate 26 for locations of borings

AS-CONSTRUCTED

SYMBOL	DATE	DESCRIPTION	BY	CK
△				
△				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

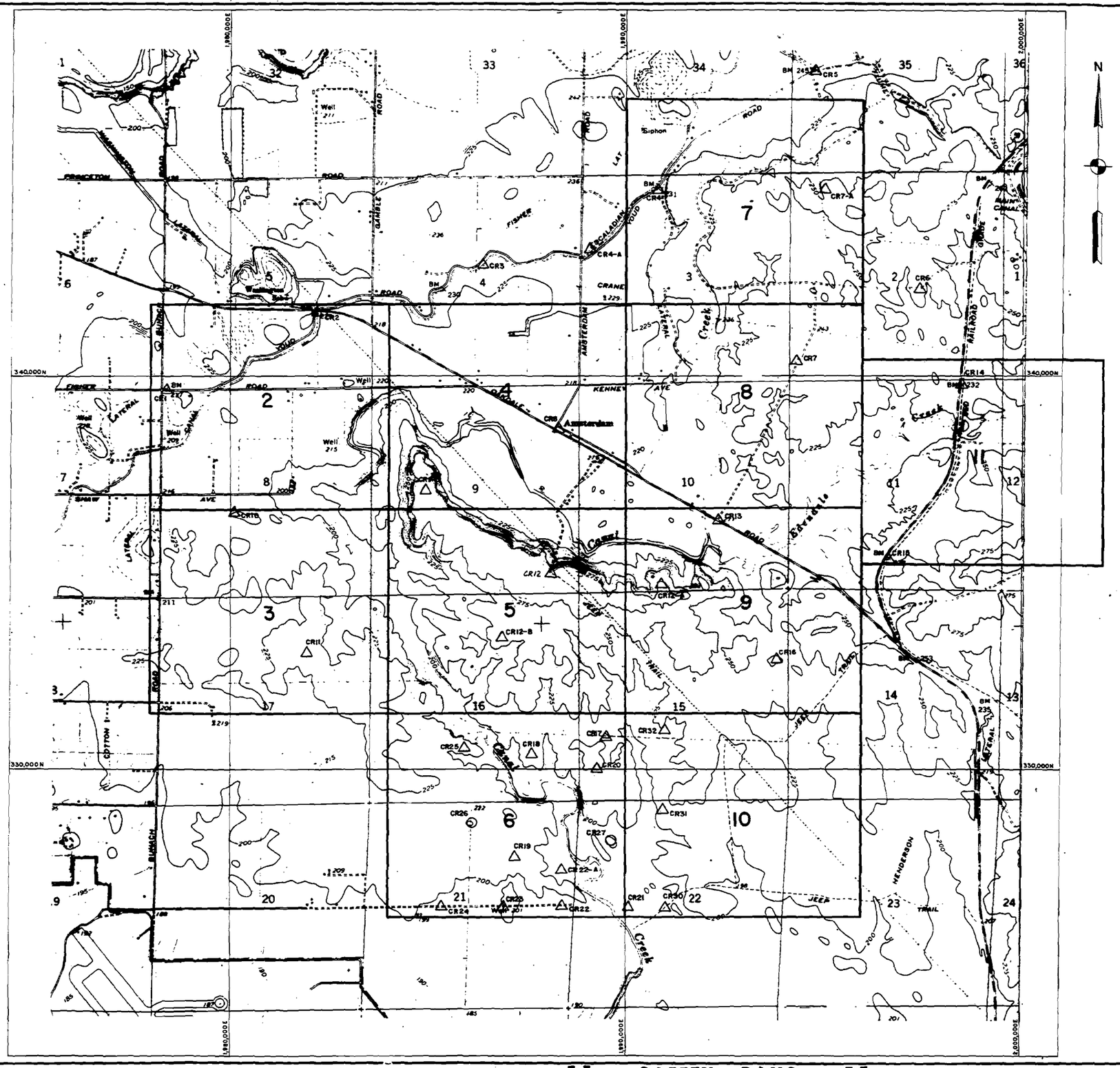
DESIGNED: D. RICKETTS
DRAWN: C. BRYSON
CHECKED: D. ANDERSON

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR
LOGS OF TRENCHES
REQUIRED BORROW AREA
4B –15 THRU 4B–21

SUBMITTED: Donald J. Anderson
DATE APPROVED: 27 March 87
SCALE: AS SHOWN
SPEC. No: 6352A
DATE: OC–21
FILE No: 46
ME–12–4–19

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

SAFETY PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

CONTROL SUMMARY

STATION	EASTING	NORTHING	ELEVATION	DESCRIPTION
CR1	1,978,274	339,729	218.1	ME 12-1 Std USCE Br Cap set in conc
CR2	1,982,223	341,803	227.0	ME 12-2 Std USCE Br Cap set in conc
CR3	1,986,181	342,797	233.2	ME 12-3 Std USCE Br Cap set in conc
CR4-A	1,989,133	343,211	233.3	5/8" Iron Pin
CR4	1,990,877	345,049	235.4	5/8" Iron Pin
CR5	1,994,675.12	347,786.34	246.1	ME 12-3 Std USCE Br Cap set in conc
CR6	1,997,347	342,313	256.6	ME 12-4 Std USCE Br Cap set in conc
CR7	1,994,730	340,886	245.0	ME 12-5 Std USCE Br Cap set in conc
CR7-A	1,995,039	344,837	256.5	5/8" Iron Pin
CR8	1,988,173	338,716	217.0	5/8" Iron Pin
CR9	1,984,724	338,029	286.3	ME 12-6 Std USCE Br Cap set in conc
CR10	1,980,074	336,644	220.3	ME 12-7 Std USCE Br Cap set in conc
CR11	1,982,119	333,543	243.4	ME 12-8 Std USCE Br Cap set in conc
CR12	1,988,717	335,140	291.86	ME 12-9 Std USCE Br Cap set in conc
CR12-A	1,990,935.61	334,754.60	285.80	5/8" Iron Pin
CR12-B	1,986,982.68	333,454.16	263.92	5/8" Iron Pin
CR13	1,992,370	336,427	210.3	5/8" Iron Pin
CR14	1,998,435	340,994	233.2	5/8" Iron Pin
CR15	1,996,601	335,514	238.0	USC & GS Br Cap BM2-235
CR16	1,992,891.25	333,282.73	272.69	5/8" Iron Pin
CR17	1,989,728.77	330,679.33	222.44	ME 12-11 Std USCE Br Cap set in conc
CR18	1,987,715.93	330,487.78	221.25	5/8" Iron Pin
CR19	DESTROYED			ME 12-10 Std USCE Br Cap set in conc
CR20	1,989,316.48	330,055.82	222.94	5/8" Iron Pin
CR21	1,990,161.87	326,609.41	186.16	5/8" Iron Pin
CR22	DESTROYED			5/8" Iron Pin
CR23	1,986,577.61	326,625.70	197.04	5/8" Iron Pin
CR24	1,985,394.77	326,623.49	200.72	5/8" Iron Pin
CR25	1,985,927.51	330,605.63	211.07	5/8" Iron Pin
CR26			214.3	5/8" Iron Pin
CR27			203.94	5/8" Iron Pin
CR30	1,991,036.56	326,553.46	195.42	5/8" Iron Pin
CR31	1,991,001.45	329,076.03	220.78	ME 12-12 Std USCE Br Cap set in conc
CR32	1,991,076.95	331,684.03	233.05	5/8" Iron Pin
CR1-A	1,979,474	339,729		
CR1-B	1,980,913	339,701		
CR4-B	1,988,794	341,353		
CR10-A	1,980,150	336,447		
CR10-B	1,978,226	337,086		
CR11-A	1,983,172	332,286		
CR22-A	1,988,387	327,515		
CR22-B	1,988,365.17	326,636.41	197.55	5/8" REBAR

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

△A NOTE: PLANS INCLUDE ONLY TOPOGRAPHY SHEETS 2, 3, 5, 6, 9, AND 10.

GRAPHIC SCALE

0 1000' 2000' 3000' 4000' 5000'

REVISION	DATE	DESCRIPTION	BY	BY
△A	15 JAN 91	NOTE ON TOPOGRAPHY SHEETS INCLUDED		
△	13 JUL 89	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SITE TOPOGRAPHY INDEX SHEET

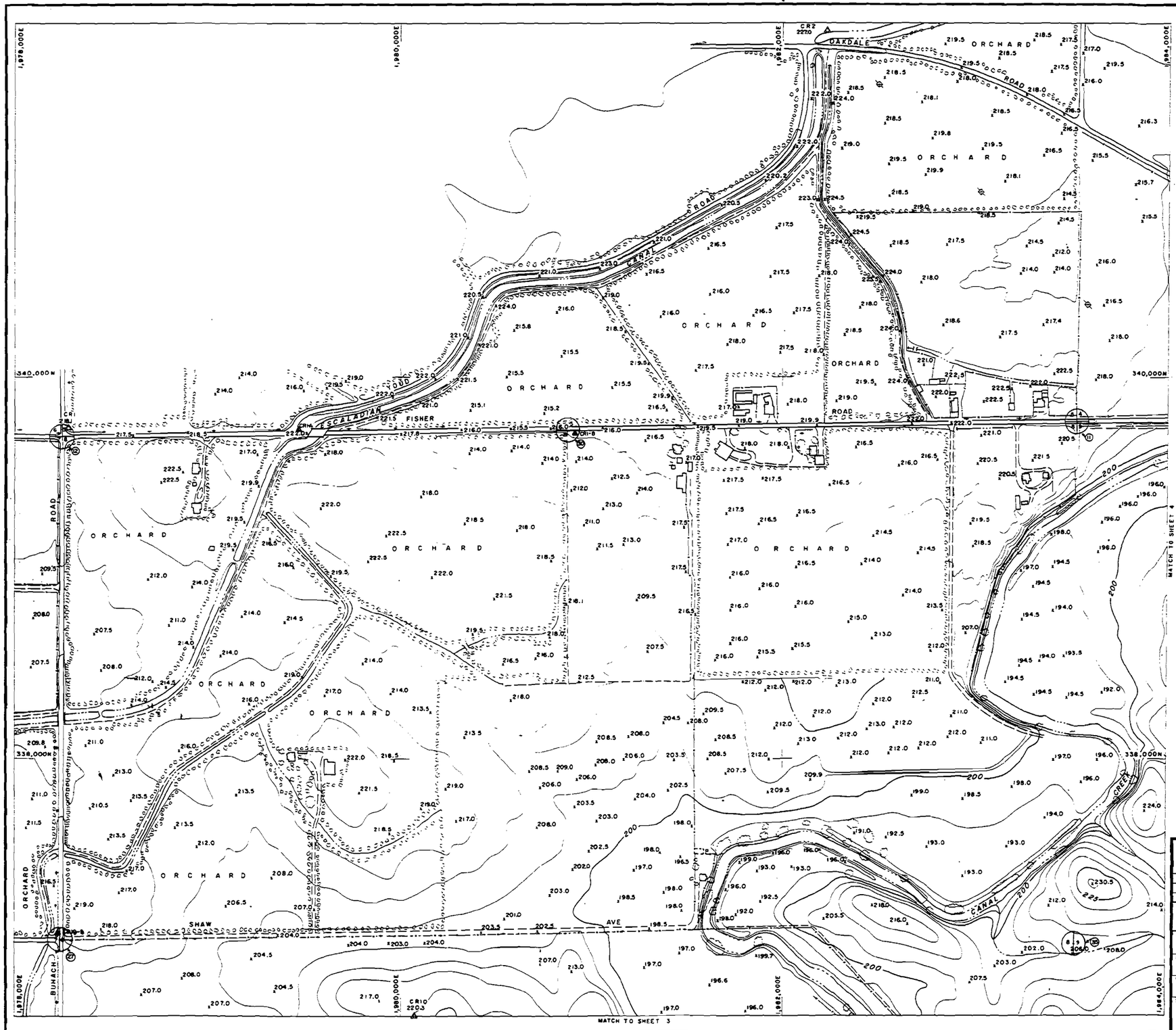
SUBMITTED: CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED: 11 JUN 83
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: T-1
FILE No.: 47
ME-12-4-19

FIELD BOOK REFERENCE: TRAVERSE 58-557 Pgs. 1-29 + 32-33, 58-558 Pgs. 1-41 + 44-46
& LEVELS 58-555 Pgs. 2-20, 58-556 Pgs. 4-23, 58-557 Pgs. 30-31 + 34-36, 58-558 Pgs 42-43

TRAVERSE COMPUTATION FOLDER NO. 1466

S/S 3671 A

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

AS-C...

REVISION	DATE	DESCRIPTION	BY	BY
1	13 JUL 89	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING
SUBMITTED: CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED: 11 June

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SITE TOPOGRAPHY SHEET 2

SCALE: AS SHOWN | SPEC. No. 6352:
SHEET: T-2 | FILE No.: ME-12-4-19
48

SAFETY PAYS

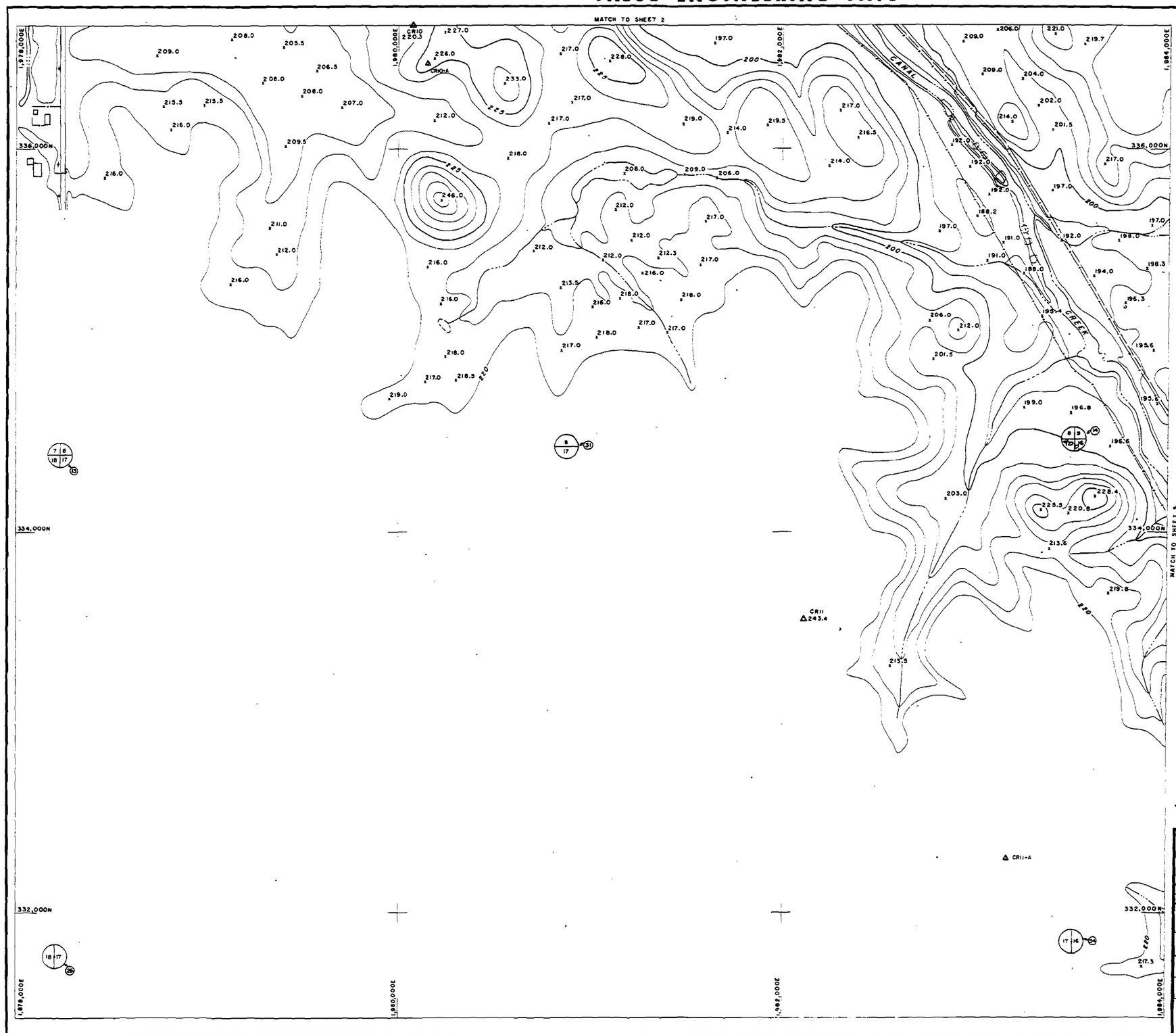
PLATE 51

FIELD BOOK REFERENCE: TRAVERSE 58-557 Pgs. 1-29 + 32-33, 58-558 Pgs. 1-41 + 44-46
& LEVELS 58-555 Pgs. 2-20, 58-556 Pgs. 4-23, 58-557 Pgs. 30-31 + 34-36, 58-558 Pgs. 42-43

TRAVERSE COMPUTATION FOLDER NO. 1464

S/S 3671 A

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRIC COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

AS-CONSTRUCTED

NUMBER	DATE	DESCRIPTION	BY	BY
1	13 JUL 89	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING
SUBMITTED: CHIEF, CIVIL PROJECTS SECTION 3

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

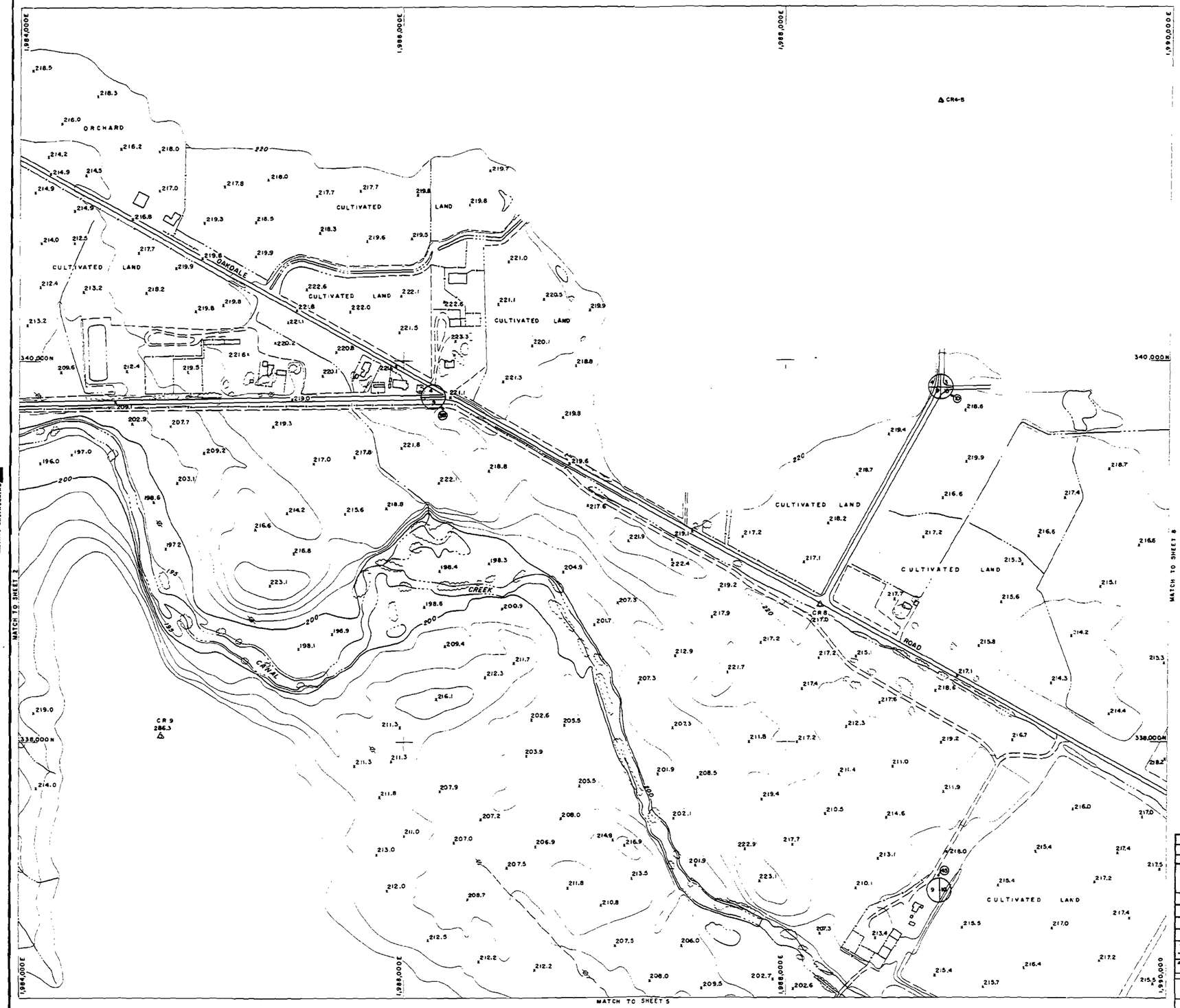
SITE TOPOGRAPHY SHEET 3

DATE APPROVED: 7 JUL 89
SCALE: AS SHOWN | SPEC. No. 6352
SHEET: T-3 | FILE No.
49 | ME-12-4-19

SAFETY PAYS

PLATE 52

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

REVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SUBMITTED:
CHIEF, SECTION:
APPROVAL RECOMMENDED: APPROVED: DATE:
CHIEF, DESIGNER CHIEF, PLANNING DIVISION
PREPARED UNDER THE DIRECTION OF
CHIEF, CORPS OF ENGINEERS, U.S.A. DISTRICT ENGINEER
SCALE: SPEC. NO.
FILE NO.
SHEETS SHEET NO.

SAFETY PAYS

EARTHDATA

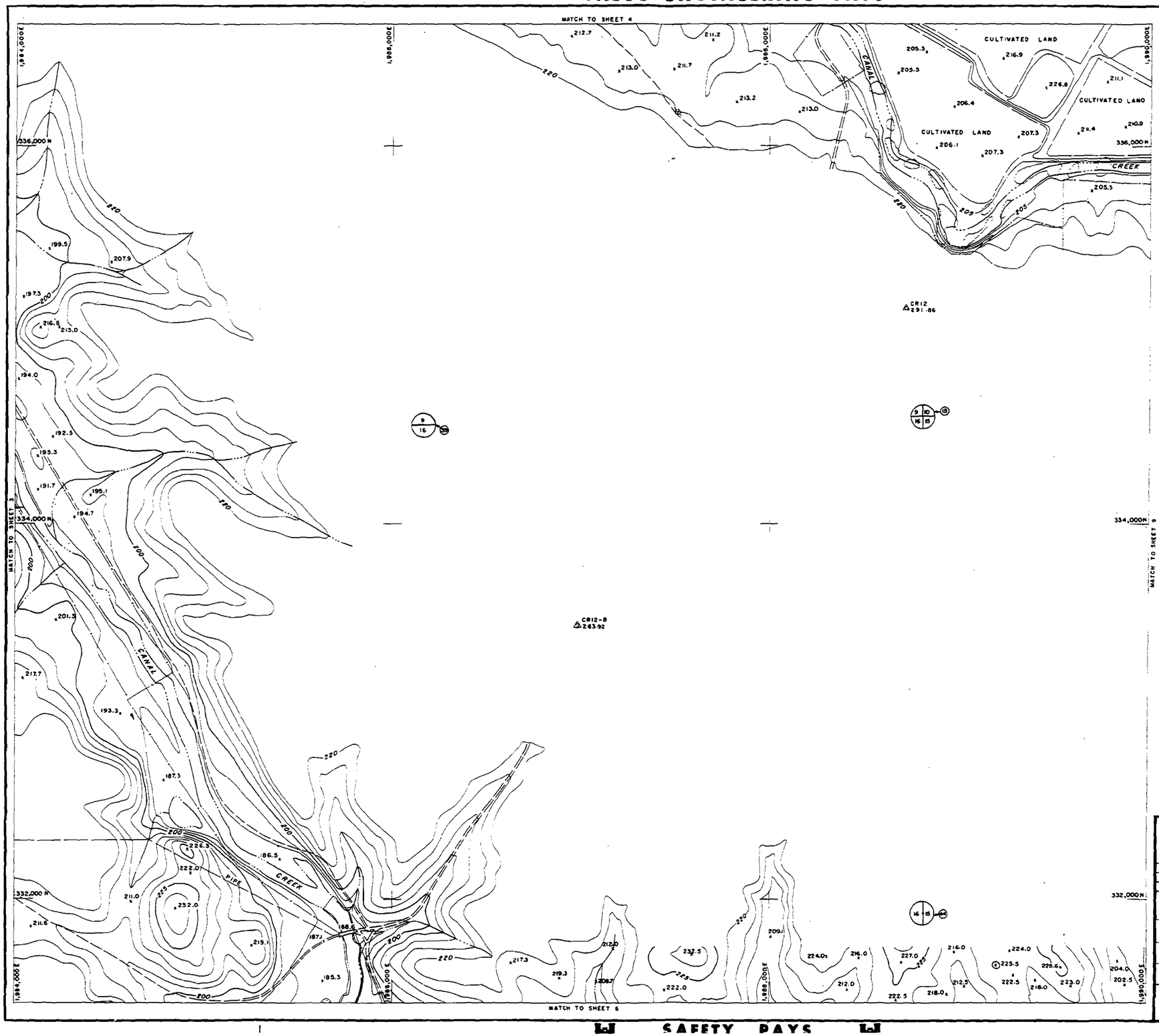
CASTLE DAM, CALIFORNIA RESERVOIR MAPPING TOPOGRAPHY FILE NO. ME-12-13-3 **PLATE 52a** Sheet 4 of 11 Sheets

FIELD BOOK REFERENCE: TRAVERSE 58-557 Pgs. 1-29 + 32-33, 58-558 Pgs. 1-41 + 44-46
& LEVELS 58-555 Pgs. 2-20, 58-556 Pgs. 4-23, 58-557 Pgs. 30-31 + 34-36, 58-558 Pgs. 42-43

TRAVERSE COMPUTATION FOLDER NO. 14

3/S 3671 A

VALUE ENGINEERING PAYS



SURVEY NOTES:
GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.
ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.
DATE OF AERIAL PHOTOGRAPHY: 5-19-78
CONTOUR INTERVAL IS 5 FEET
ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3
THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:
GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.
COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE
0 200' 400' 600' 800' 1000'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY
1	13 JUL 80	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING
SUBMITTED: CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED: 7-1-80

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SITE TOPOGRAPHY SHEET 5

SCALE: AS SHOWN | SPEC. No. 6352-
SHEET: T-4 / 50 | FILE No. ME-12-4-19

SAFETY PAYS

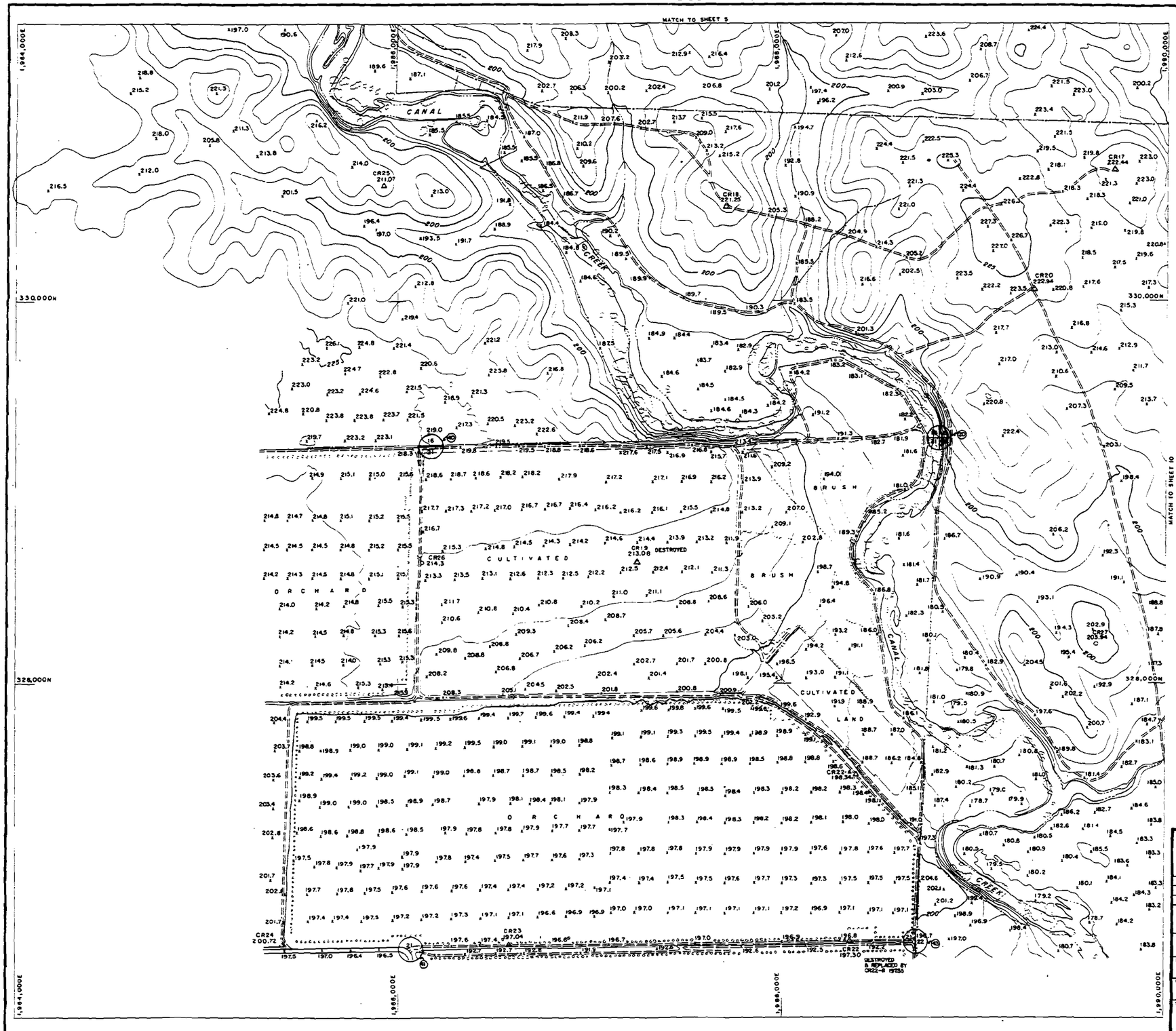
PLATE E2

FIELD BOOK REFERENCE: TRAVERSE 58-557 Pgs. 1-29 + 32-33, 58-558 Pgs. 1-41 + 44-46
& LEVELS 58-555 Pgs. 2-20, 58-556 Pgs. 4-23, 58-557 Pgs. 30-31 + 34-36, 58-558 Pgs. 42-43

TRAVERSE COMPUTATION FOLDER NO. 1466

S/S 3671 A

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200 400 600 800 1000

AS-C[illegible]

1	13 JUL 89	NEW SHEET		
0				

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SITE TOPOGRAPHY SHEET 6

SUBMITTED: Darrell Horton
CHIEF, CIVIL PROJECTS SECTION 3

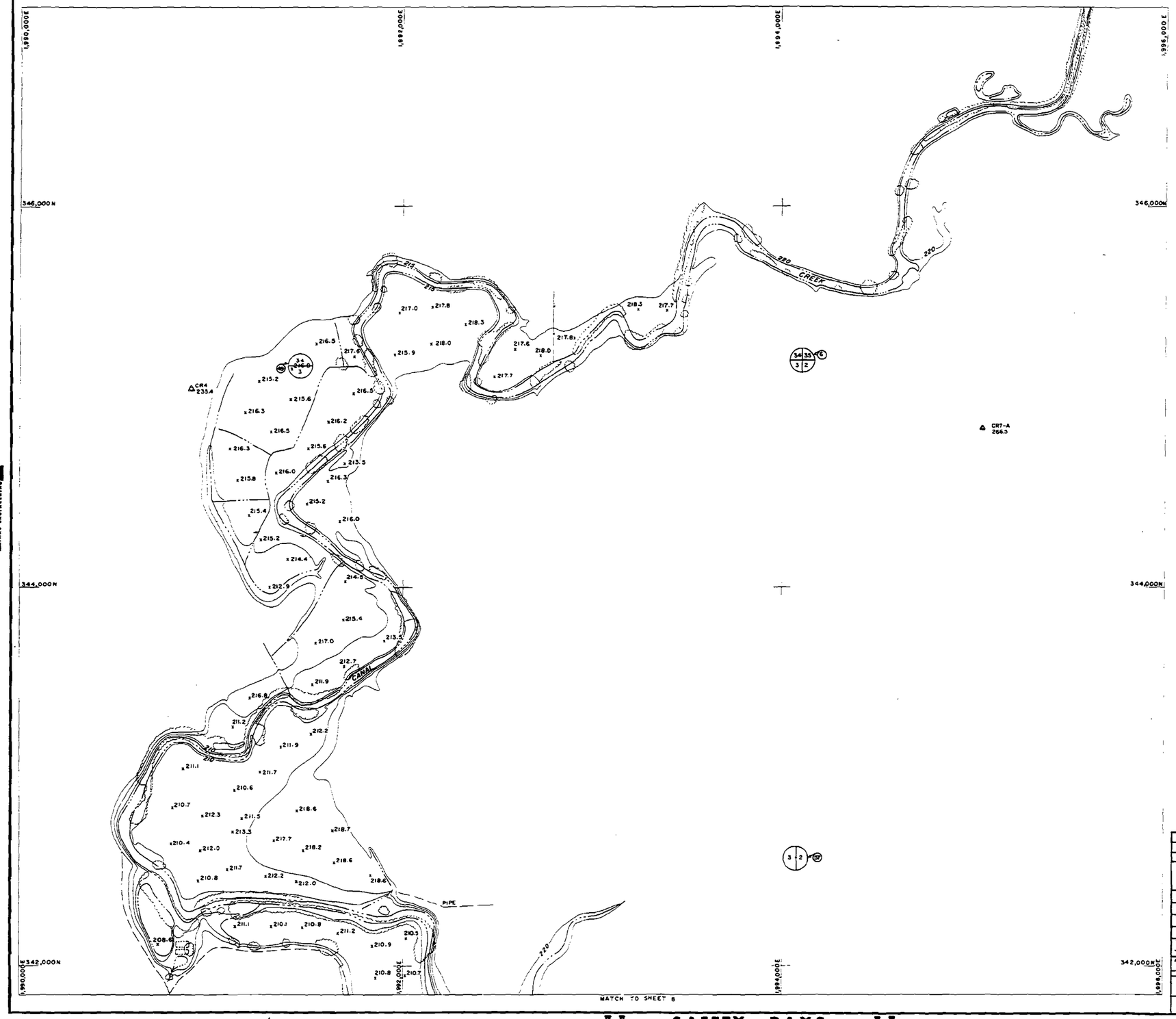
DATE APPROVED: 11 JUL 89

SCALE: AS SHOWN | SPEC. No. 6352
SHEET: T-5 51 | FILE No. ME-12-4-19

SAFETY PAYS

PLATE 5

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

NOTE:

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COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

REVISION	DATE	DESCRIPTION	BY	BY

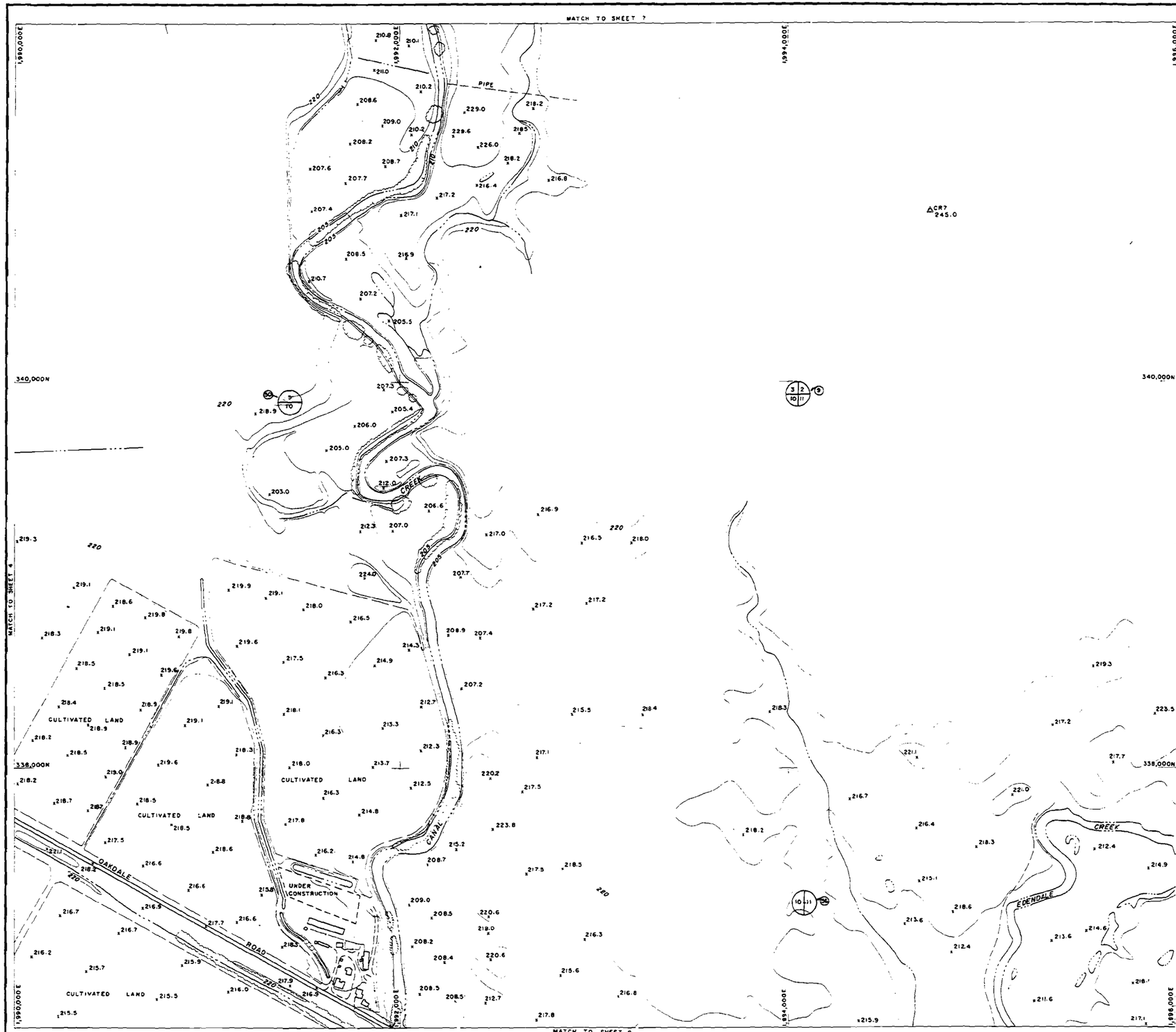
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED BY:
DRAWN BY:
CHECKED BY:
PREPARED BY:
SUBMITTED:
DATE: REVIEW:
REVIEWING RECOMMENDED: APPROVED: DATE:
CHIEF, DESIGN CHIEF, ENGINEERING DIVISION
PREPARED UNDER THE DIRECTION OF SCALE: SPEC. NO.
FILE NO.
CHIEF, CORPS OF ENGINEERS, U.S.A. DISTRICT ENGINEER SHEETS SHEET NO.

SAFETY PAYS

EARTHDATA

CASTLE DAM, CALIFORNIA RESERVOIR MAPPING TOPOGRAPHY FILE NO. ME-12-13-3 **PLATE 54a**



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 5 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

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COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

DIVISION	DATE	DESCRIPTION	BY	BY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

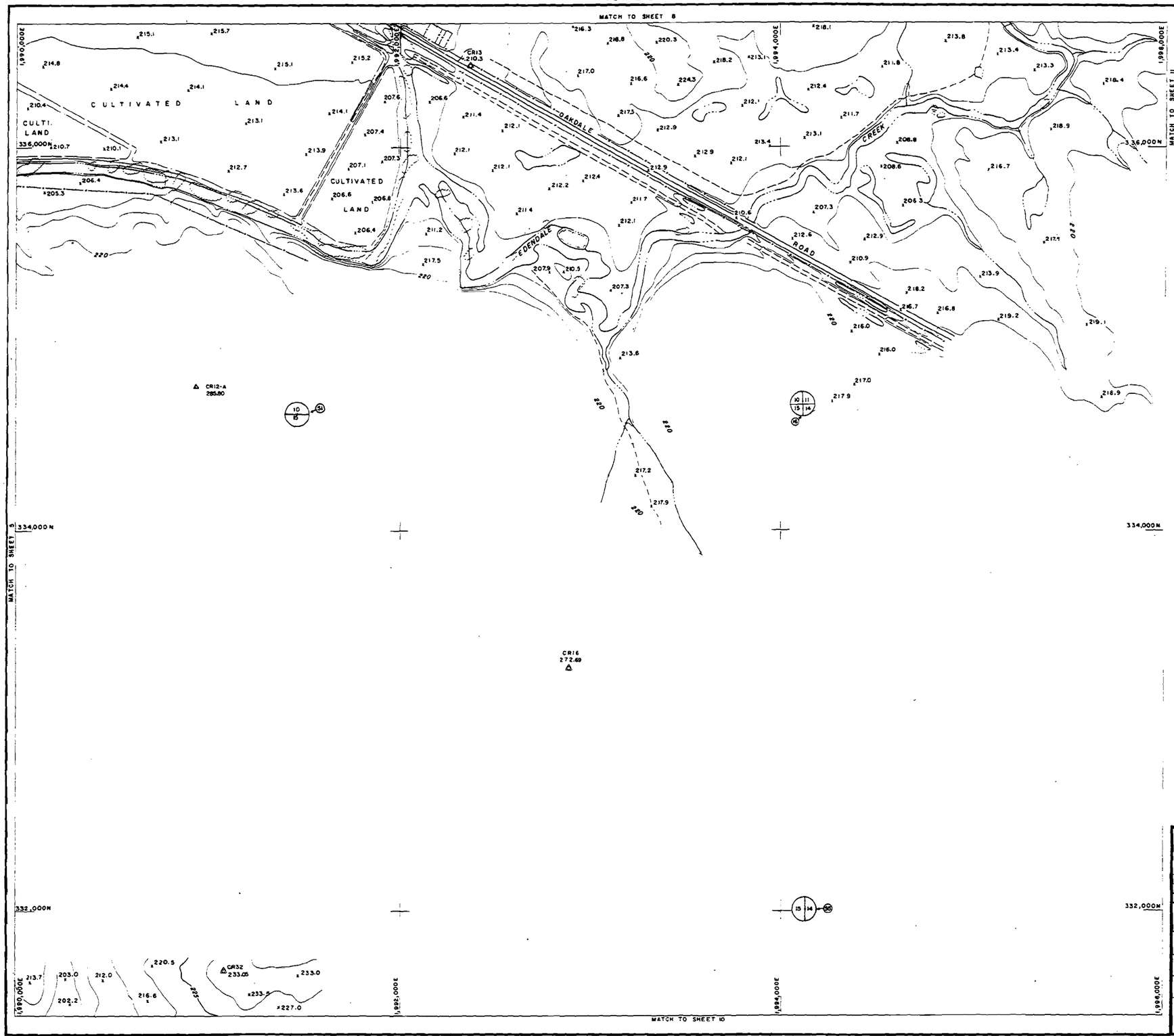
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, DIVISION
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:
PREPARED UNDER THE DIRECTION OF
CDR., CORPS OF ENGINEERS, U.S.A.
DISTRICT ENGINEER
SCALE:
SPEC. NO.
FILE NO.
SHEETS
SHEET NO.

FIELD BOOK REFERENCE: TRAVERSE 58-537 Pgs. 1-29 + 32-33, 58-558 Pgs. 1-41 + 44-46
8 LEVELS 58-555 Pgs. 2-20, 58-556 Pgs. 4-23, 58-557 Pgs. 30-31 + 34-36, 58-558 Pgs. 42-43

TRAVERSE COMPUTATION FOLDER NO. 1466

S/S 3671 A

VALUE ENGINEERING PAYS



SURVEY NOTES:

GRID COORDINATES REFER TO THE CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO SEA LEVEL DATUM OF 1929.

DATE OF AERIAL PHOTOGRAPHY: 5-19-78

CONTOUR INTERVAL IS 3 FEET

ORIGINAL SURVEY SHOWN ON DRAWING FILE No. ME-12-13-3

THIS MAP MEETS THE NATIONAL STANDARDS OF ACCURACY FOR TOPOGRAPHIC MAPS PREPARED BY PHOTOGRAMMETRIC METHODS.

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GRID TICKS SHOWN ON THESE DRAWINGS SHOULD BE USED WITH CAUTION AS THEY MAY BE IN ERROR AS MUCH AS 10 FEET DUE TO NEW TIES AND A RECOMPUTATION OF THE ORIGINAL SURVEY.

COORDINATE VALUES SHOWN FOR CONTROL POINTS ARE ONLY ACCURATE TO THE DECIMAL PLACE INDICATED.

N

GRAPHIC SCALE

0 200' 400' 600' 800' 1000'

AS-CONSTRUCTED

REVISION	DATE	DESCRIPTION	BY	BY
1	13 JUL 88	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: S. BARTH
DRAWN: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SITE TOPOGRAPHY SHEET 9

SUBMITTED: CHIEF, CIVIL PROJECTS SECTION 3
DATE APPROVED:
SCALE: AS SHOWN
SPEC. No. 6352A
SHEET: T-6 / 52
FILE No.: ME-12-4-19

SAFETY PAYS

DI ATF 55

CORNER NUMBER	COORDINATES NORTH	COORDINATES EAST	DESCRIPTION
1	344,981.25	1,978,291.96	1/2" IRON PIN IN CONCRETE AT INT. BUHACH RD. & PRINCETON RD.
2	345,054.40	1,983,562.38	1/2" REBAR AT INT. GAMBLE & PRINCETON ROADS.
3	345,128.70	1,988,829.35	1-1/4" O.D. IRON PIPE AT INT. AMSTERDAM & PRINCETON ROADS. IRON PIPE IN CONC., TAGGED L.S. 2457.
4	350,410.66	1,988,888.63	BRASS DISC. L.S. 4052 IN CENTERLINE AMSTERDAM ROAD. AFFIXED TAG. L.S. 2457.
5	350,471.07	1,994,157.93	2" O.D. IRON PIPE, 12" DOWN ON SOUTH SIDE OF ORCHARD ROAD.
6	345,197.60	1,994,106.86	1-1/4" IRON PIPE TAGGED L.S. 2457, 1 FT. DOWN.
7	345,290.52	1,999,380.93	1-1/4" O.D. IRON PIPE, TAGGED L.S. 2457, IN HOLE.
8	340,018.53	1,999,308.25	1-1/4" ROUND IRON BAR 12" DOWN IN E-W FENCE LINE.
9	338,933.40	1,994,052.48	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457
10	339,859.57	1,988,800.00	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, AT INT. AMSTERDAM ROAD AND KENNEY AVE. IN CONCRETE COLLAR "1982 L.S. 2457"
11	339,764.40	1,983,521.10	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
12	339,683.98	1,978,246.57	3/4" I.D. IRON PIPE TAGGED L.S. 656, AT INT. BUHACH AND FISHER ROADS.
13	334,409.19	1,978,227.54	3/4" IRON BAR IN CONCRETE, AT INT. PALM AVE. AND BUHACH ROAD.
14	334,487.27	1,983,520.08	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457. POURED CONCRETE COLLAR AROUND PIPE AND SCRIBED "1982 L.S. 2457".
15	334,571.34	1,988,809.29	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457. POURED CONCRETE COLLAR AROUND PIPE AND SCRIBED "1982 L.S. 2457".
16	334,657.32	1,994,115.72	OLD AUTO AXLE 12" DOWN.
17	334,688.84	1,999,412.95	OLD FENCE CORNER POST (FENCES RUNNING S.E. & N.N.W.) WITH NAIL & SHINER IN TOP.
18	329,365.71	1,999,418.05	OLD FENCE CORNER POST WITH FENCES RUNNING N. AND E.
19	329,362.77	1,994,138.43	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
20	329,283.11	1,988,822.38	MON. POSITION FALLS IN CREEK, FLOWING 6'-10' DEEP AT TIME OF SURVEY.
21	329,210.13	1,983,519.88	CONC. MON. WITH INVERTED HARROW TOOTH 1.0 FT DOWN IN E.-W. FENCE LINE.
22	329,136.09	1,978,177.83	3/4" IRON BAR IN CONCRETE AT INT. BUHACH ROAD AND EUCALYPTUS AVE.
23	323,927.61	1,983,338.52	MONUMENT HAS BEEN DESTROYED. POSITION DETERMINED FROM RECORD OF SURVEY (R-4), DRAWING (R-24) & NEARBY FND. MONUMENTS.
24	324,002.56	1,988,594.10	2" O.D. IRON PIPE, IN N-S. FENCE STAMPED "SEC. COR. 21,22,27 & 28".
25	324,068.22	1,993,883.26	5/8" REBAR TAGGED L.S. 2457. POURED CONCRETE COLLAR AROUND REBAR AND SCRIBED "L.S. 2457".
26	331,777.93	1,978,202.74	5/8" REBAR, TAGGED R.C.E. 13760, AT INT. BUHACH ROAD AND MERCEDES AVE.
27	337,046.12	1,978,236.90	5/8" REBAR AT INT. BUHACH ROAD AND SHAW AVE.
28	NO SEARCH MADE	NO SEARCH MADE	BUHACH ROAD NEAR OAKDALE ROAD
29	NO SEARCH MADE	NO SEARCH MADE	PRINCETON ROAD BETWEEN BUHACH AND GAMBLE ROADS
30	339,724.19	1,980,883.34	1-1/4" O.D. IRON PIPE, TAGGED L.S. 2457, IN FISHER ROAD.
31	334,448.22	1,980,873.48	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN OPEN PASTURE.
32	329,173.11	1,980,848.86	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN E-W. FENCE LINE.
33	326,569.36	1,983,429.16	1-1/4" O.D. IRON PIPE, TAGGED L.S. 2457, POURED CONCRETE COLLAR AROUND PIPE AND SCRIBED "1982 L.S. 2457".
34	331,848.70	1,983,519.98	1-1/4" O.D. IRON PIPE, TAGGED L.S. 2457. IN OPEN RANGELAND.
35	337,125.84	1,983,520.59	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN OPEN RANGELAND.
36	342,404.78	1,983,541.70	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN GAMBLE RD.
37	345,091.38	1,986,195.38	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN PRINCETON RD.
38	339,811.99	1,986,160.55	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN FISHER ROAD, 100' + W. OF INT. WITH OAKDALE ROAD.
39	334,529.30	1,986,164.36	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN OPEN RANGELAND.
40	329,246.62	1,986,171.13	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN E-W FENCE LINE.
41	326,604.65	1,986,067.25	1-1/4" O.D. IRON PIPE TAGGED "COUNTY SURVEYOR", 1.5' DOWN AT INT. FOX ROAD. & OLIVE AVE.
42	323,965.92	1,985,966.32	2" O.D. IRON PIPE, NO TAG, 1.5' DOWN, IN FOX ROAD.
43	326,642.75	1,988,707.37	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457. CONCRETE COLLAR SCRIBED "1982 L.S. 2457". IN N-S. FENCE LINE.
44	331,927.21	1,988,815.84	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN OPEN RANGELAND.
45	337,215.46	1,988,804.64	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN AMSTERDAM ROAD.
46	342,495.78	1,988,814.68	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN AMSTERDAM ROAD.
47	347,769.68	1,988,858.99	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457, IN AMSTERDAM ROAD.
48	350,440.60	1,991,523.35	4-1/2" O.D. PVC PIPE, SET OVER 1/4 SECTION MON. PER OWNER, MR. ERNEST
49	345,164.99	1,991,462.21	2" DISC ON 2" O.D. PIPE IN E.-W. FENCE LINE. DISC STAMPED 1/4 S34/S3, T.5S., R.13E.; T.6S., R.13E., L.S. 3294
50	339,896.48	1,991,426.24	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
51	334,614.33	1,991,462.17	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
52	329,322.94	1,991,480.07	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
53	324,061.93	1,991,238.56	5/8" REBAR TAGGED L.S. 2457. IN E-W FENCE LINE, CONCRETE COLLAR AROUND REBAR AND SCRIBED "1982 L.S. 2457".
54	326,715.50	1,994,010.85	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
55	332,010.05	1,994,127.08	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
56	337,295.36	1,994,084.10	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
57	342,571.44	1,994,079.73	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
58	347,837.91	1,994,133.80	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457
59	345,244.06	1,996,748.89	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
60	339,975.96	1,996,680.04	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
61	334,673.07	1,996,764.00	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
62	337,353.69	1,999,360.60	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
63	342,647.96	1,999,349.49	1-1/4" O.D. IRON PIPE TAGGED L.S. 2457.
64	321,326.00	1,985,952.94	BRASS CAP MON. IN CONC. STAMPED "WAR DEPARTMENT, CORPS OF ENGINEERS-BDY MON", 1.0' E. OF CASTLE AFB BOUNDARY FENCE.

CORNER NUMBER	COORDINATES NORTH	COORDINATES EAST	DESCRIPTION

AS-CONSTRUCTED

DIVISION	DATE	DESCRIPTION	BY	BY
1	13 JUL 89	NEW SHEET		

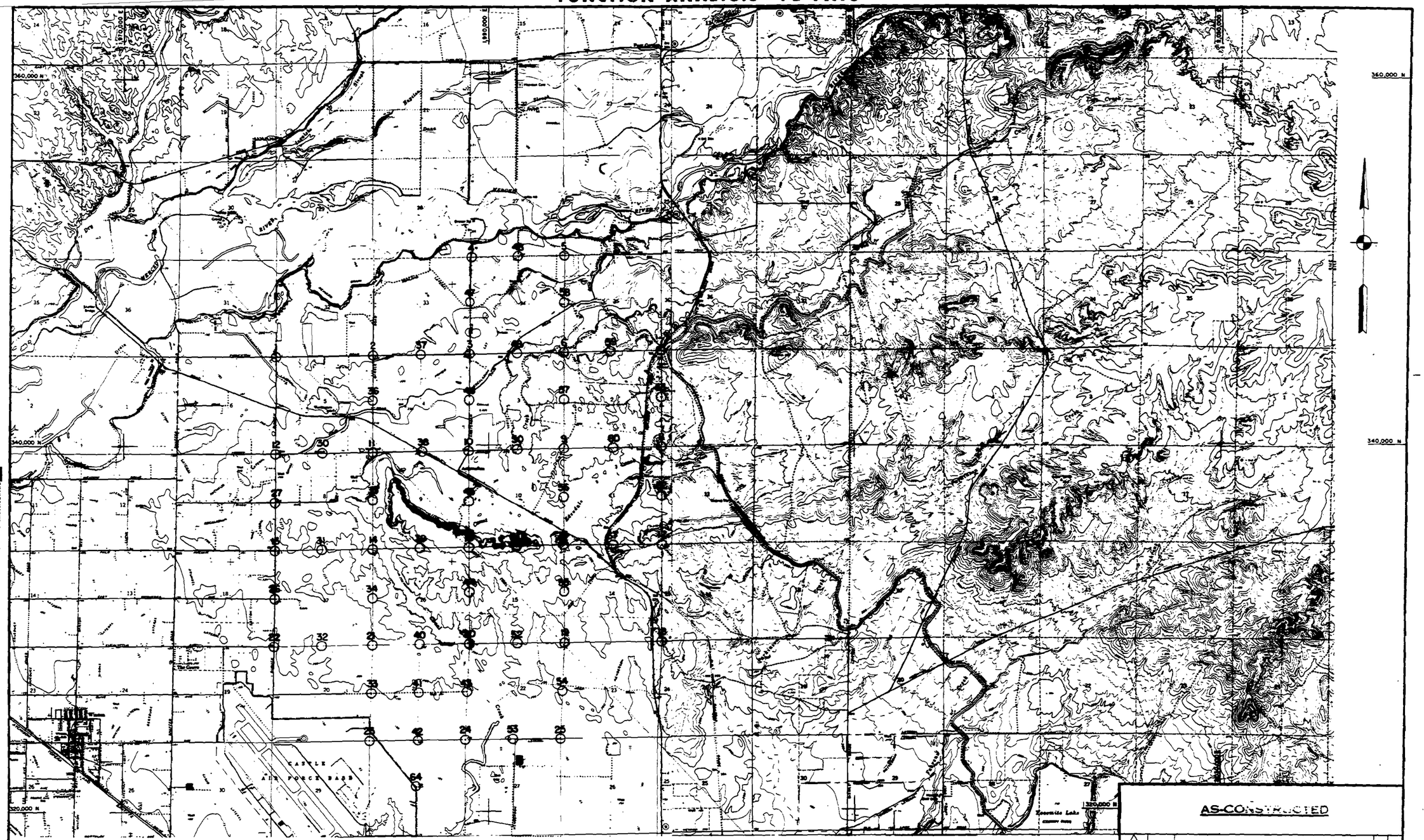
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

S. BARTH
E. CLAWSON
L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SURVEY COORDINATE SHEET

SUBMITTED: Darrell Hartz, CHIEF, CIVIL PROJECTS SECTION "B"
DATE APPROVED: 11 July 89
SCALE: NO SCALE
SHEET T-8 54
FILE NO. ME-12-4-19
SPEC. No. 6352A



SURVEY NOTES

THIS MAP WAS PREPARED FROM U.S.G.S. QUADRANGLE SHEETS WINTON AND YOSEMITE LAKE, CALIFORNIA.

GRID COORDINATES REFER TO CALIFORNIA STATE COORDINATE SYSTEM, ZONE III.

ALL ELEVATIONS REFER TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

ORIGINAL SURVEY SHOWN ON DRAWING FILE NO. ME-12-13-3

TRAVERSE COMPUTATION FOLDER NO 12 E 311

NOTE

CORNER 28 - NO SEARCH MADE - BUHACH RD NEAR OAKDALE RD

CORNER 29 - NO SEARCH MADE - PRINCETON RD. BETWEEN BUHACH & GAMBLE RDS.

GRAPHIC SCALE

0 5' 10' 20' 40' 60' 80' 100'

AS-CONSTRUCTED

REVISION	DATE	REMARKS	BY	BY
1	13-JUL 80	NEW SHEET		

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DRAWN: S. BARTH
DESIGNED: E. CLAWSON
CHECKED: L. RENNING

MERCED COUNTY STREAMS
CANAL CREEK, CALIFORNIA
CASTLE DAM AND RESERVOIR

SURVEY COORDINATE INDEX SHT.

SUBMITTED: Donald Lee Zo
CHIEF, CIVIL PROJECTS SECTION "B"

DATE APPROVED: 11 Jul 1980

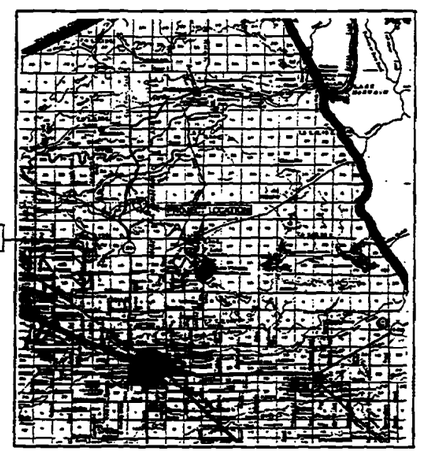
SCALE: AS SHOWN | SPEC. No. 6352-

SHEET: T-9 55

FILE No. ME-12-4-19

CONSTRUCTION DRAWINGS FOR
MERCED COUNTY STREAMS, CALIFORNIA

MAIN CANAL CHECK STRUCTURE NEAR EDENDALE CREEK



VICINITY MAP

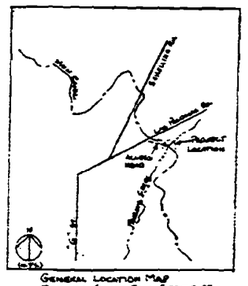
LOCATION MAP

PROJECT NO.

EWP - EC-37-01-89

SHEET INDEX

DRAWING DESCRIPTION	NO.
GENERAL INFORMATION SHEET	G-1
SITE PLAN	C-1
LOG OF DRILL HOLES	C-2
EXCAVATION PLAN, PROFILE & SECTION	C-3
FOUNDATION PLAN AND DETAILS	S-1
FRAMING PLAN AND DETAILS	S-2
TRUSS PLAN AND DETAILS	S-3
FAHRENS CREEK GATE STRUCTURE	S-4



GENERAL LOCATION MAP
FAHRENS CREEK GATE STRUCTURE

AS-CONSTRUCTED
CONTRACT NO 93-C-0032

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY STREAMS, CALIFORNIA
MAIN CANAL CHECK STRUCTURE
NEAR EDENDALE CREEK
GENERAL INFORMATION SHEET

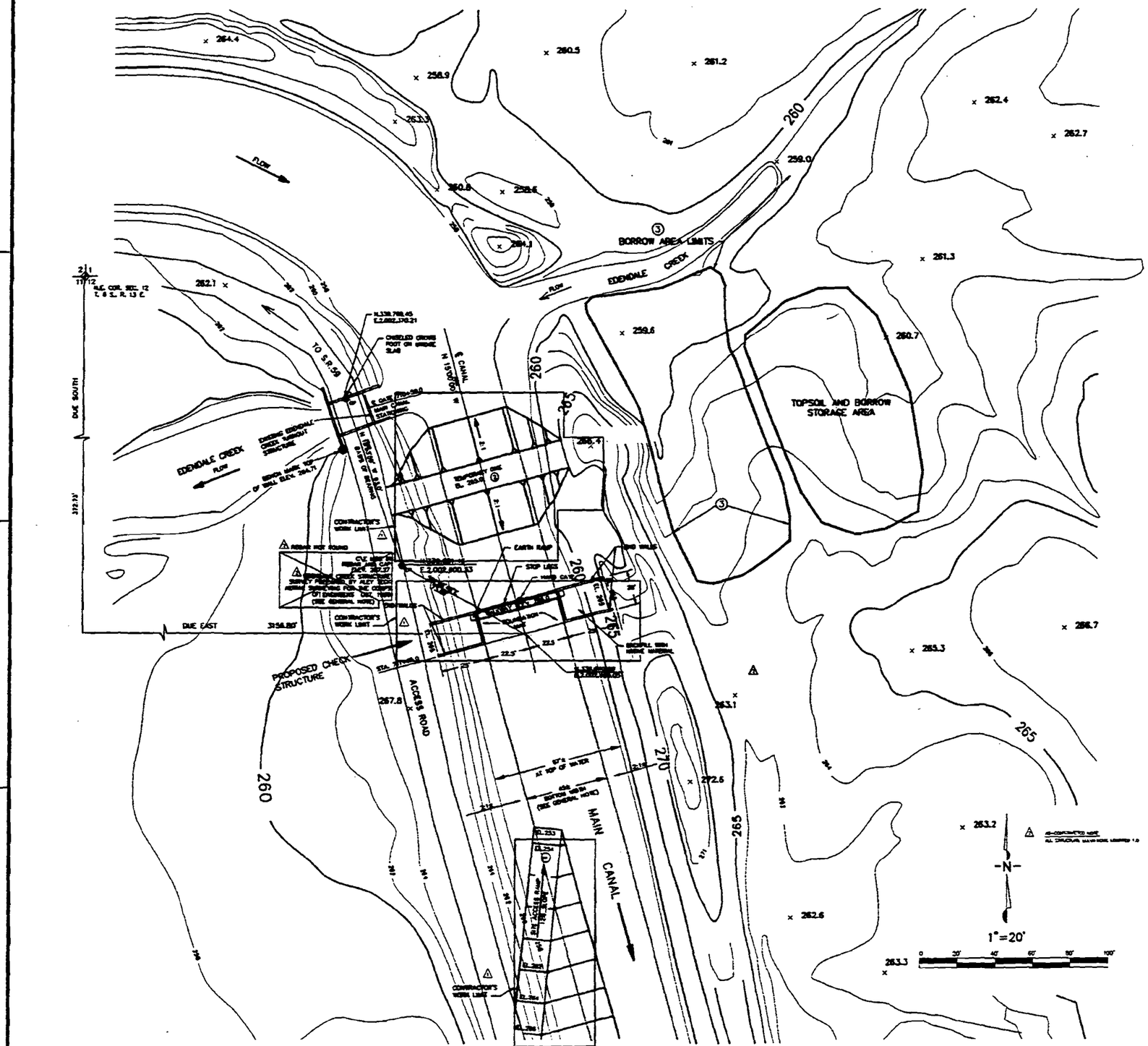
SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDEXED ON THIS SHEET

LAURENCE R. SADOFF

AS SHOWN
G-1
ME-25-157

SAFETY3 PAYS

FUNCTION ANALYSIS - VE PAYS



LEGEND

- SURVEY CONTROL POINT
- SECTION CORNER
- CONTROL POINT OR BENCH MARK
- SECTION OR DETAIL NUMBER
- SHEET NUMBER LOCATION

CONC.	CONCRETE
ELEV.	ELEVATION
GALV.	GALVANIZED
O.C.	ON CENTERS
F	FLOW LINE
C	CENTERLINE
A.S.	AS SHOWN
SCH.	SCHEDULE
A.B.	ANCHOR BOLT
T.C.	TOP OF CONCRETE
MIN.	MINIMUM
MAX.	MAXIMUM
B.W.	BOTH WAYS
W/	WITH
CL	CLEARANCE
E.F.	EACH FACE
R/	REMOVE
T & B	TOP & BOTTOM

GENERAL NOTES

CANAL GEOMETRY INCLUDING BOTTOM WIDTH, SIDE SLOPES AND FLOWLINE ELEVATION INFORMATION HAS BEEN ASSUMED BASED UPON REFERENCE TO THE "MAIN CANAL HEAD TO END PROFILE AND X-SECTION DRAWINGS", 1954, FROM MERCED IRRIGATION DISTRICT. TOPOGRAPHIC MAPPING TAKEN FROM "MERCED STREAMS GROUP MAIN CANAL GATE STRUCTURE TO EDENDALE CREEK STRUCTURE SURVEY AND TOPOGRAPHY MAPPING", 1989, AS PROVIDED BY THE CORPS OF ENGINEERS FROM ALEY TECH AERIAL SURVEYING. ACTUAL GROUND AND FLOWLINE ELEVATIONS WERE NOT AVAILABLE AND THEREFORE MAY VARY FROM DRAWINGS. CONTRACTOR TO MODIFY THE CANAL GEOMETRY, AS DIRECTED BY THE COR/S ENGINEER, TO FIT THE GEOMETRY OF THE CHECK STRUCTURE.

SHEET NOTES

1. SITE ACCESS RAMP TO ASSIST IN CONSTRUCTION ACCESS, IS SHOWN IN TENTATIVE LOCATION. FINAL LOCATION IS SUBJECT TO SUBMITTAL OF "DIKE AND DIVERSION OF WATER" PLAN, WITHIN (30) THIRTY DAYS AFTER THE AWARD OF THE CONTRACT. CONSTRUCTION OF THE RAMP SHALL BE EXECUTED WITHOUT CUTTING OR EXCAVATING INTO EXISTING LEVEE. AFTER CONSTRUCTION, RAMP SHALL BE REMOVED AND THE AREA REVEGETATED.
2. TEMPORARY DIKE IS SHOWN AS A MEANS OF "DIKE AND DIVERSION OF WATER" DIKE DIMENSIONS SHOWN ARE APPROXIMATE. ALTERNATIVE MEANS TO DIVERT AND CONTROL FLOOD OR INCIDENTAL FLOW ARE ACCEPTABLE AS APPROVED BY THE CONTRACTING OFFICER. DIKE SHALL BE CAPABLE OF MAINTAINING NORMAL CHANNEL CAPACITY FLOWS OF 2000 CFS AND STANDARD PROJECT FLOOD FLOWS OF 3100 CFS AT ELEVATION 263+2 FEET OF FREEBOARD, WHETHER OR NOT THE TURNOUT GATES ARE OPEN OR CLOSED AT EDENDALE AND CANAL CREEKS. TEMPORARY DIKE TO BE REMOVED AND AREA RESTORED TO PRE-PROJECT CONDITIONS AFTER CONSTRUCTION OF PROJECT IS COMPLETE.
3. ELIMINATED
4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH MERCED IRRIGATION DISTRICT AS TO THE LOAD REQUIREMENTS PRIOR TO CROSSING ANY CREEK STRUCTURE WITH HEAVY EQUIPMENT.
5. CONTRACTOR WILL NEED TO PROVIDE OFF-SITE BORROW MATERIAL FROM HIS OWN SOURCE TO CONSTRUCT A TEMPORARY SITE ACCESS RAMP TO GAIN ACCESS TO THE BORROW AREA TO BUILD THE FULL SCALE SITE ACCESS RAMP (SHOWN), TEMPORARY DIKE AND NEW DIKE. EXCAVATION AND CONSTRUCTION OF THE CHECK STRUCTURE IN THE BOTTOM OF THE MAIN CANAL CAN THEN BE ACCESSED FROM THE SITE ACCESS RAMP.
6. ADDITIONAL BORROW MATERIAL SHALL BE OBTAINED BY THE CONTRACTOR FROM AN OFF-SITE, GOVERNMENT APPROVED SOURCE. THE SOURCE OF THE ADDITIONAL BORROW SHALL BE FURNISHED TO THE GOVERNMENT FOR APPROVAL 30 DAYS PRIOR TO INITIATING BORROW OPERATIONS. FOR EVALUATION OF IMPACT ON FISH, WILDLIFE, ENDANGERED SPECIES, AND CULTURAL RESOURCES AT THE SITE.
7. PAYMENT FOR ANY OFF-SITE BORROW MATERIAL REQUIRED SHALL BE INCLUDED INCLUDED UNDER BIDDING SCHEDULE ITEM NO. 1, "EXCAVATION, BACKFILL".

NOTE:

MERCED IRRIGATION DISTRICT HAS A STOCKPILE OF MATERIAL A FEW HUNDRED YARDS DOWNSTREAM OF THE CHECK STRUCTURE ON THE MAIN CANAL. IF THE CONTRACTOR WANTS TO USE THIS FOR BORROW MATERIAL, THE CONTRACTOR WILL BE RESPONSIBLE FOR PURCHASING THE MATERIAL FROM MERCED IRRIGATION DISTRICT.

AS-CONSTRUCTED

15 JULY 92	AS-CONSTRUCTED	
7 JUNE 93	ADD CONTRACTOR'S WORK LIMITS, REMOVE NOTES	
REVISION	DATE	DESCRIPTION

SCHAFF SATTER AND PRIMATER ENGINEERS

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

R. ELDER/M. KOBE
R. ELDER/C. CURTIS
R. JOHNSON

MERCED COUNTY — MERCED COUNTY
MERCED COUNTY STREAMS, CALIFORNIA

MAIN CANAL CHECK STRUCTURE
NEAR EDENDALE CREEK

SITE PLAN

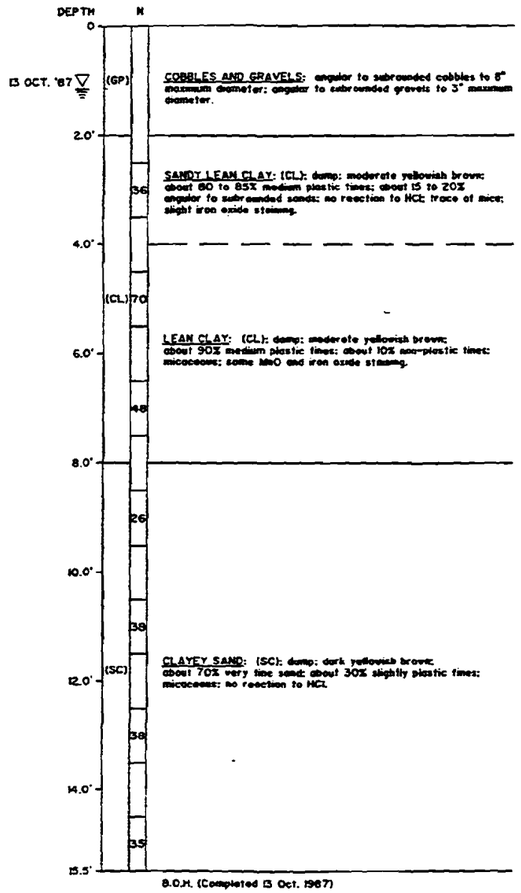
/S/ DARRELL HORTON
CHIEF, CIVIL PROJECT SECTION "B"

15 JULY 92

SCALE: VARIES | SHEET No. 3875
SHEET C-1 | 2
FILE No. ME-25-157

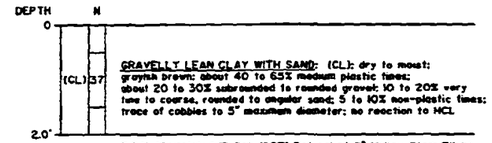
WORKING SCALE: 1"=20' (1:240) 07/10/96, 14:17, KOB FILTICHER

2F-87-20



B.O.H. (Completed 13 Oct. 1987)

2F-87-21



B.O.H. (Completed 13 Oct. 1987) Refusal of 8" Hollow Stem Flight Auger on Cobbles.

STANDARD PENETROMETER DESCRIPTIVE DATA

COHESIONLESS		COHESIVE	
Blows*	Relative Density	Blows*	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-20	Firm	5-8	Firm
21-30	Very Firm	9-15	Stiff
31-50	Dense	16-30	Very Stiff
51+	Very Dense	31+	Hard

* Blows per 1.0 ft. of penetration of a 2-inch O.D. and 1-3/8-in. I.D. Sampler driven by a 140-lb. hammer with a 30-in. traverse.

NOTES:

1. Explorations were conducted with an 8" Diameter Hollow Stem Flight Auger and Standard Penetrometer.
2. ( ) denotes visual Field Identification of Soil.
3. N denotes Number of Blows for Standard Penetrometer.
4. 13 OCT. '87 ▽ denotes groundwater encountered on date shown.
5. Color names used are in accordance with Geological Society of America's Rock Color Chart.
6. Soil Identifications and Descriptions are based upon ASTM D 2488-84, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

AS CONSTRUCTED

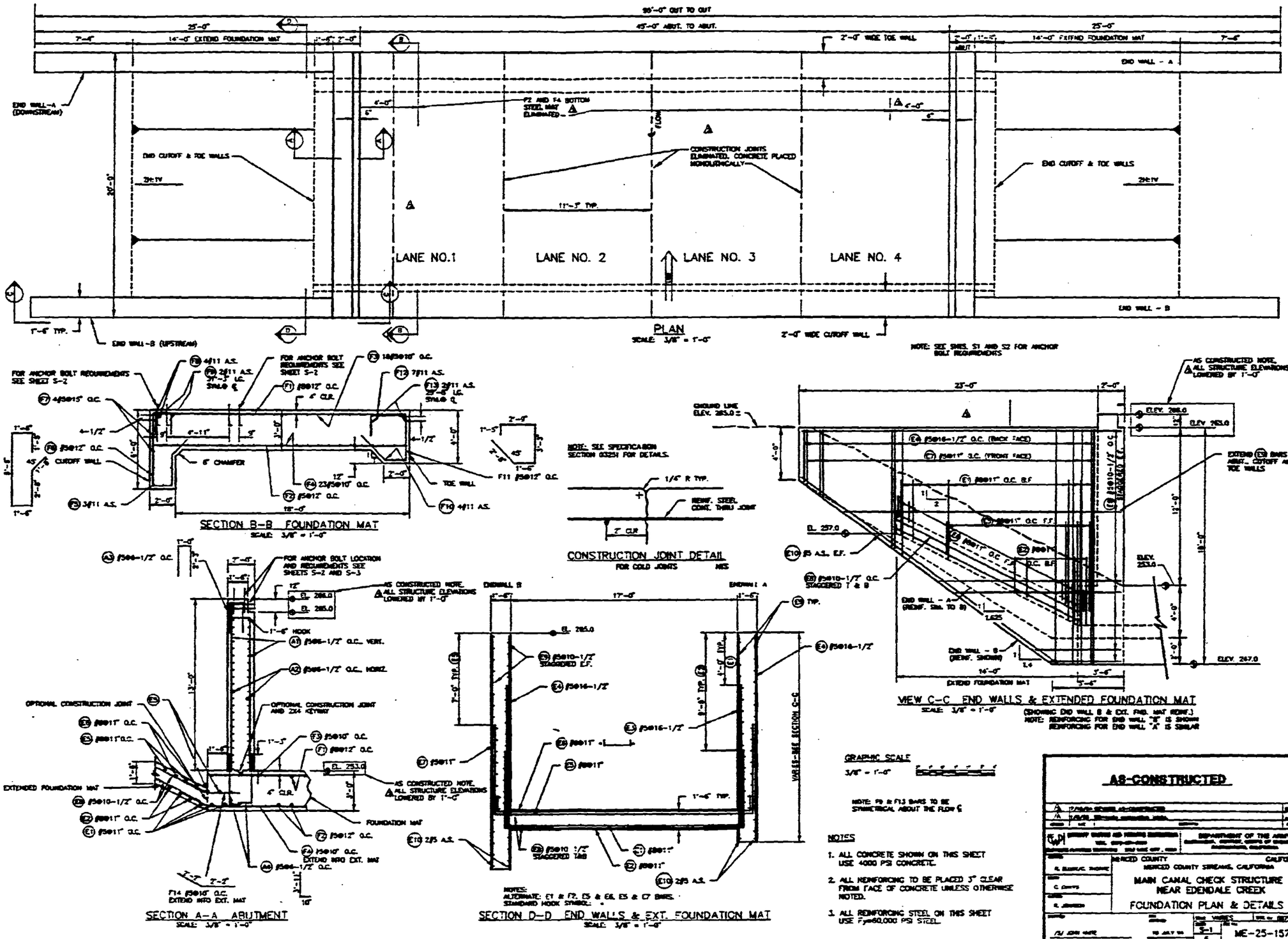
GRAPHIC SCALE

1 0 1 2 3 4 5 FEET

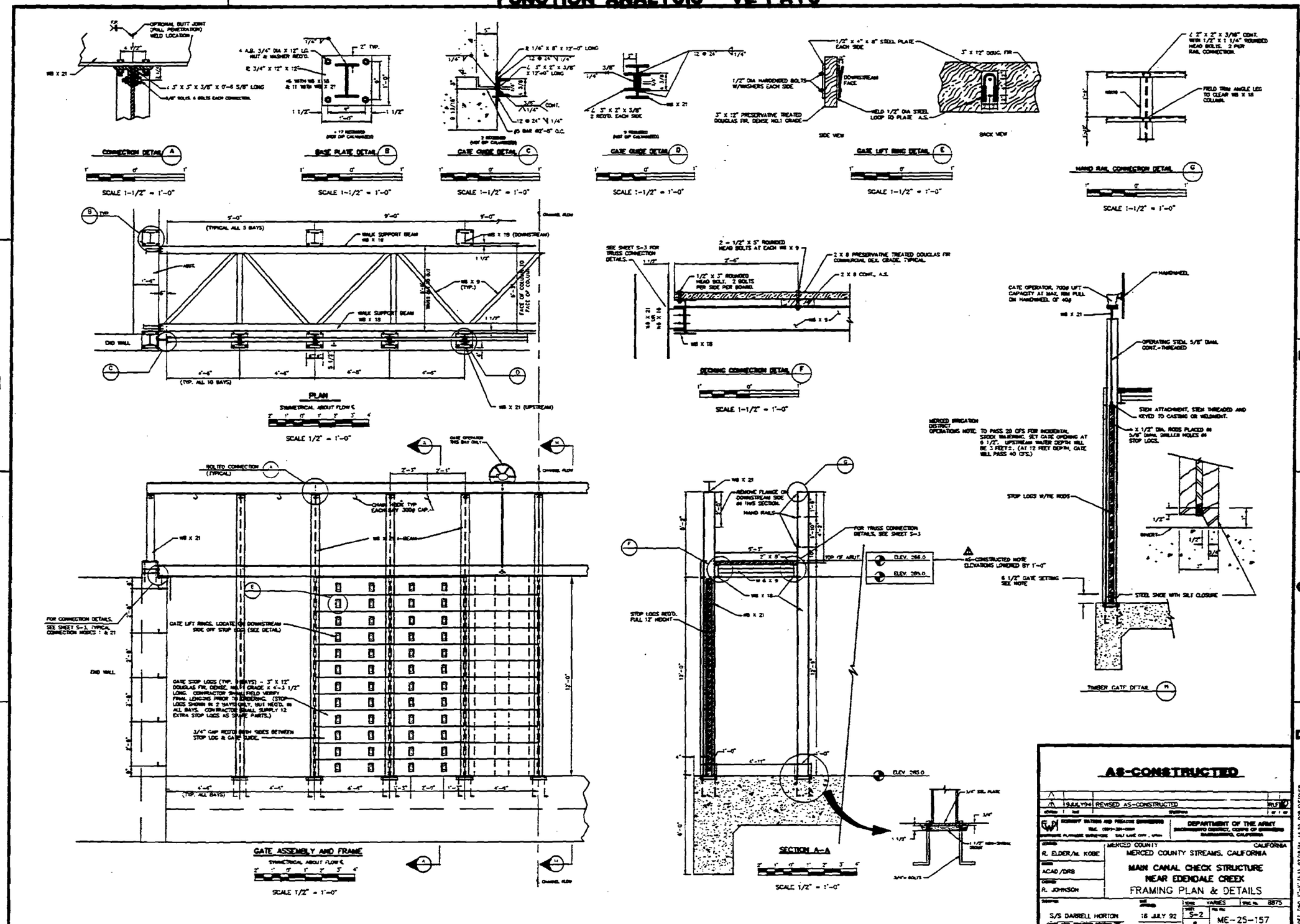
SCALE: 1" = 1 FOOT

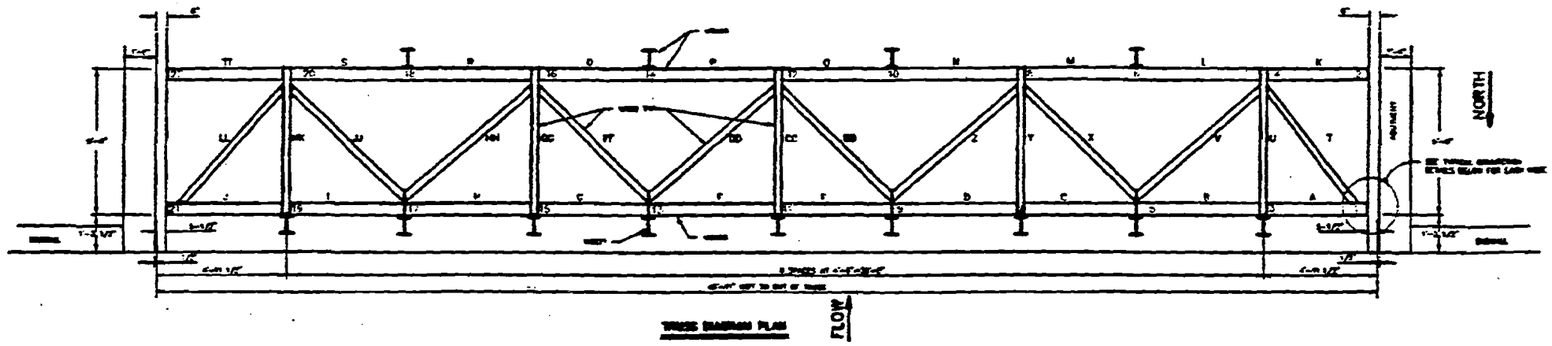
GEOTECHNICAL BRANCH SOIL DESIGN SECTION	DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA
R. BRADLEY	MERCED COUNTY STREAMS, CALIFORNIA MAIN CANAL CHECK STRUCTURE NEAR EDENDALE CREEK
R. BRADLEY	
D. RICKETTS	LOGS OF DRILL HOLES 2F-87-20 AND 2F-87-21
	1" = 1 FOOT C-2 ME-25-157

FUNCTION ANALYSIS - VE PAYS



FUNCTION ANALYSIS - VE PAYS





LOAD TABLE

MEMBER	SHAPE	LOAD
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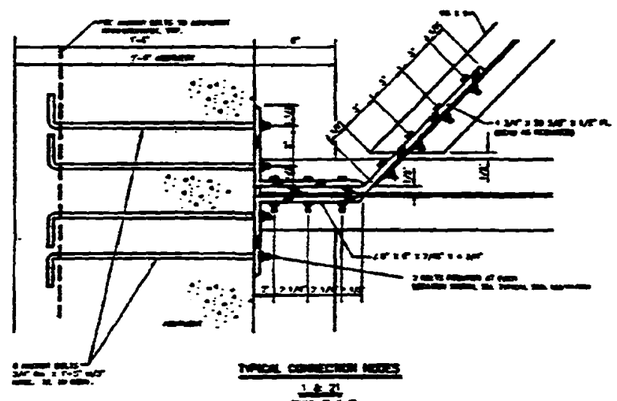
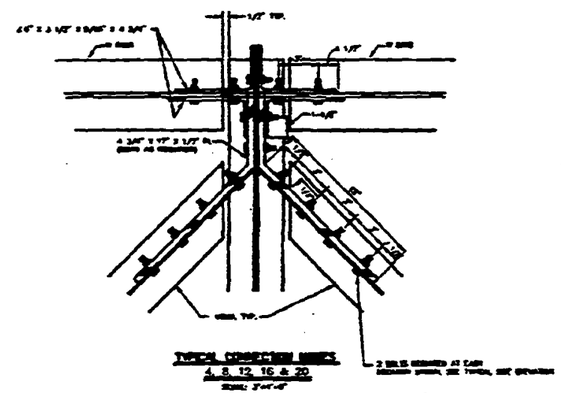
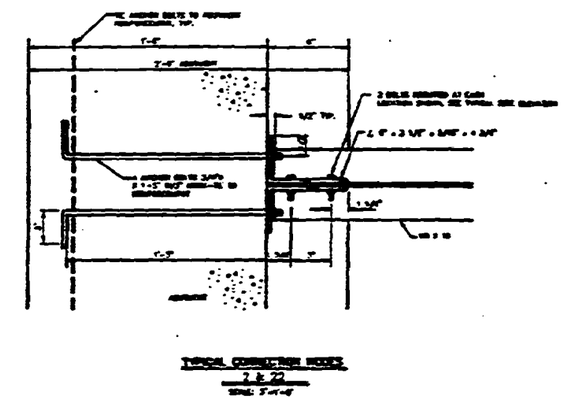
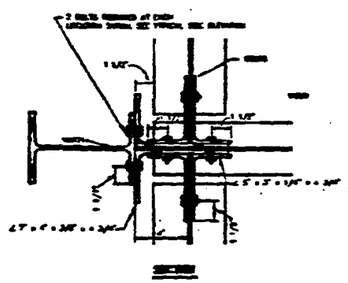
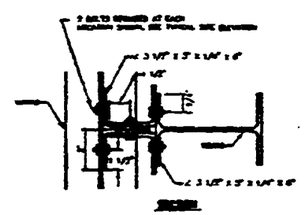
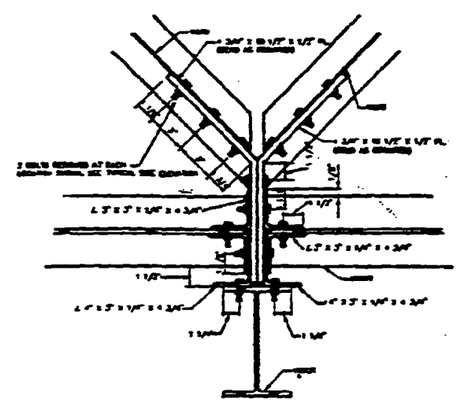


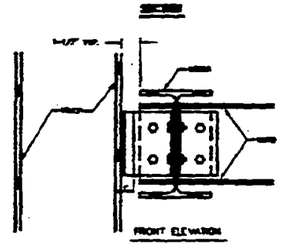


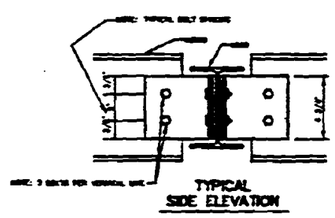


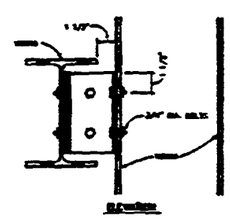












NOTES

1. [illegible]
2. [illegible]
3. [illegible]

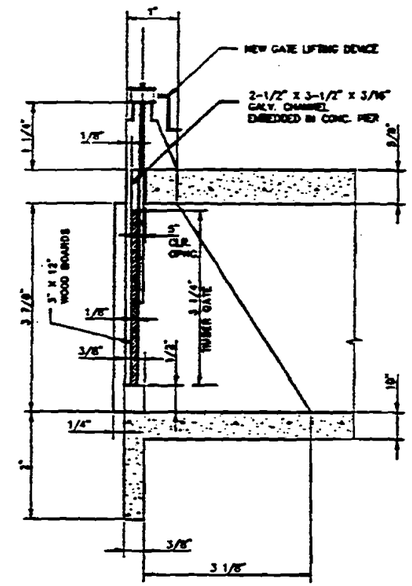
AS CONSTRUCTED

R. ELDER	MERCED COUNTY, CALIFORNIA MERCED COUNTY STREAMS, CALIFORNIA
ACAD R.B.	MAIN CANAL CHECK STRUCTURE NEAR EDENDALE CREEK
R. JOHNSON	TRUSS PLAN AND DETAILS
/S/ DARRELL NORTON	16 JULY 82 — SHEET 5-3 of 7 — NE-25-157

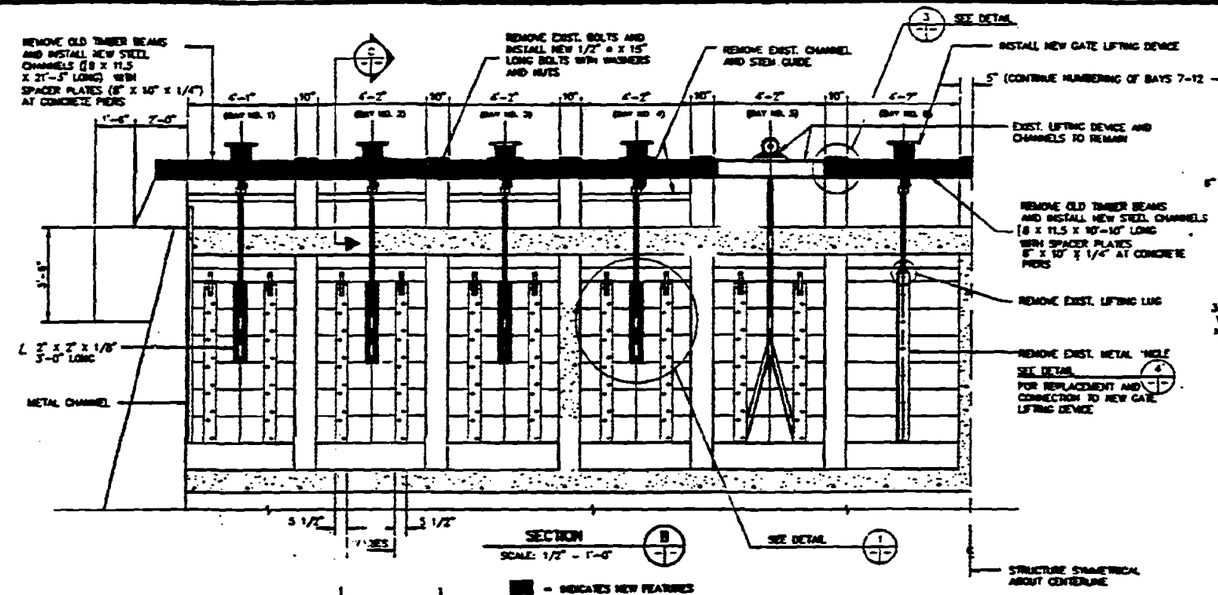
DEPARTMENT OF THE ARMY

SAFETY PAYS

PLATE 65

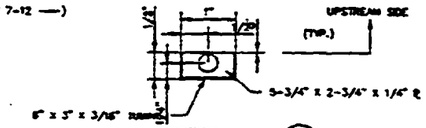


SECTION A
SCALE: 1/2" = 1'-0"

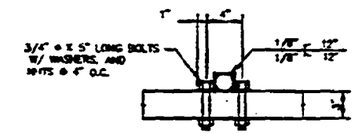


SECTION B
SCALE: 1/2" = 1'-0"

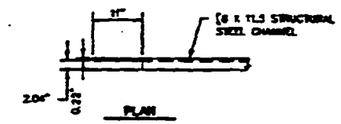
■ - INDICATES NEW FEATURES



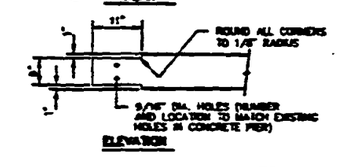
SECTION E
N.T.S.



SECTION D
SCALE: 1'=1'-0"

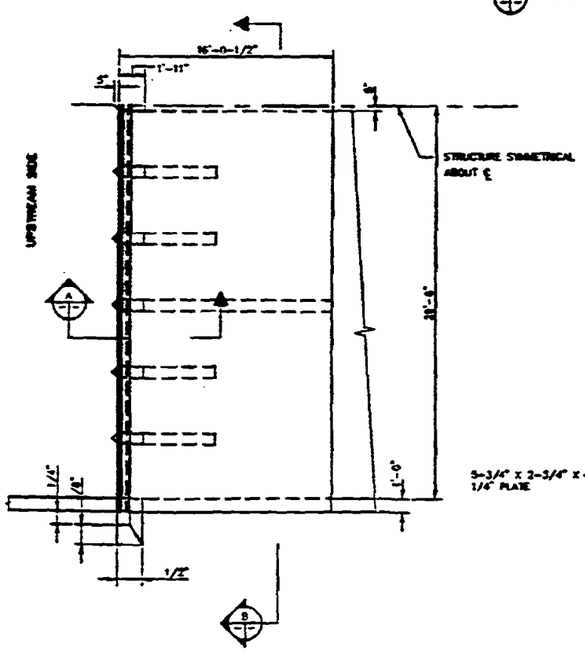


PLAN



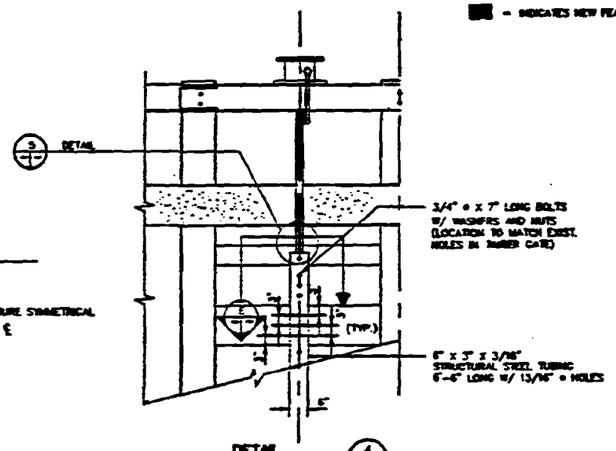
ELEVATION

DETAIL 3
SCALE: 1'=1'-0"

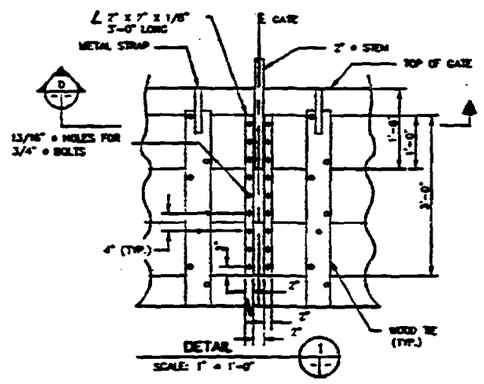


HALF PLAN
SCALE: 1/4" = 1'-0"

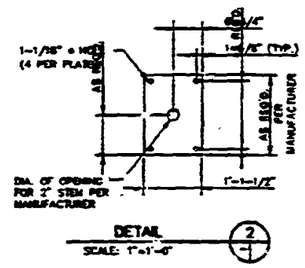
NOTE: GATE LIFTING DEVICES ARE NOT SHOWN FOR CLARITY



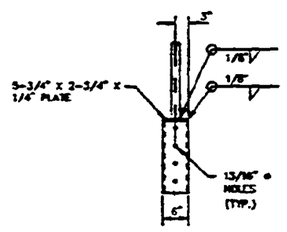
DETAIL 4
SCALE: 1-1/2" = 1'-0"



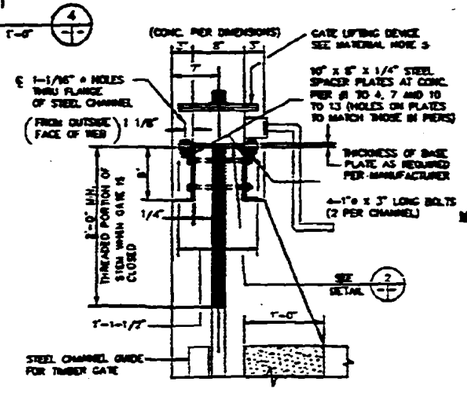
DETAIL 1
SCALE: 1" = 1'-0"



DETAIL 2
SCALE: 1'=1'-0"



DETAIL 5
SCALE: 1'=1'-0"



SECTION C
SCALE: 1-1/2" = 1'-0"

CONSTRUCTION NOTES:

1. REMOVE EXISTING STEM GUIDES BETWEEN CONCRETE PIERS (8 EACH) AND THEN PATCH HOLES IN CONCRETE PIER.
2. REMOVE EXISTING TIMBER SUPPORT BEAMS (10 BAYS).
3. INSTALL NEW STRUCTURAL STEEL CHANNELS (10 BAYS) - SEE DETAIL 3) AND SPACER PLATES.
4. REMOVE EXISTING LIFTING LUG AT TOP OF TIMBER GATES AT 6TH AND 7TH BAYS.
5. PER DETAILS 1, 2, SECTIONS C & D, INSTALL NEW GATE LIFTING DEVICES (1ST TO 4TH BAY, 9TH TO 12TH BAY).
6. PER DETAILS 2, 4, 5, SECTIONS C & E, REMOVE EXISTING METAL ANGLE AT BACK OF TIMBER GATES AND REPLACE WITH STRUCTURAL STEEL TUBING. INSTALL NEW GATE LIFTING DEVICE (6TH AND 7TH BAYS).
7. NOTIFY PROJECT ENGINEER IMMEDIATELY IF ANY OF THE EXISTING STOP LOGS NEED TO BE REPLACED.

MATERIAL NOTES: △

1. ALL STRUCTURAL TUBINGS SHALL BE ASTM A500, GRADE B. ALL OTHER STRUCTURAL STEEL SECTIONS SHALL BE ASTM 588 WITH A MINIMUM YIELD POINT OF 50 KSI.
2. ALL BOLTS, WASHERS, AND NUTS (ASTM 307, GRADE A) SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.
3. ALL STEEL SHALL BE FIELD PAINTED WITH A RUST INHIBITIVE PRIMING PAINT (E.G. USE TNEMEC CO. INC.'S PAINT NO. 99 OR EQUAL). THE PAINT COLOR IS TO BE SPECIFIED BY MERCED IRRIGATION DISTRICT (SEE MATERIAL NOTE 6).
4. WELDING SHALL CONFORM TO REQUIREMENTS OF AWS CODES AND AISC SPECIFICATIONS.
5. GATE LIFTING DEVICES AND STEMS SHALL BE CAPABLE OF EXERTING A MINIMUM 7500 LB. THRUST (E.G. USE RODNEY HUNT'S BENCH STAND MODEL, BS 5084 WITH 2" ø STAINLESS STEEL STEM OR EQUAL). BEFORE INSTALLATION, SUBMIT SHOP DRAWINGS AND MANUFACTURER'S LITERATURE TO PROJECT ENGINEER FOR APPROVAL.
6. PRIOR TO PUTTING ON THE PRIMING PAINT, LOOSE PAINT AND RUST SHALL BE REMOVED BY WIRE BRUSHING. A FINISH COAT SHALL BE APPLIED OVER THE PRIMING COAT USING A COMPATIBLE, WATER AND WEATHER RESISTANT PAINT (CONTRACTOR'S OPTION). △
7. GATE GUIDE CHANNELS SHALL BE PAINTED TO THE WATER LINE.

GENERAL NOTES:

1. FOR GENERAL LOCATION MAP SHOWING FAHRENS CREEK GATE STRUCTURE, SEE SHEET G-1.
2. △ THE CONTRACTOR IS TO VERIFY LOCATIONS AND DIMENSIONS PRIOR TO FABRICATION.

AS CONSTRUCTED

△ △ 11/6/95 Length, General and Material Notes, add notes.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY — CALIFORNIA

MERCED COUNTY STREAMS
FAHRENS CREEK GATE STRUCTURE
GATE LIFTING DEVICES
PLAN, SECTIONS AND DETAILS

DESIGNED: M. MA
DRAWN: C. BROWNELL
CHECKED: C. WONG
DATE APPROVED: 15 JULY 92
SCALE: AS SHOWN
FILE NO. 3-4
SHEET 8
ME-25-157

SAFETY IS PAYS

PLATE 66

CASTLE DAM AND RESERVOIR

TRASHRACK MODIFICATION

US Army Corps of Engineers
Sacramento District

SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL CHANGES IN THIS SET AS NOTED ON THIS SHEET

APPROVAL RECOMMENDED: CHIEF, CIVIL DESIGN BRANCH

APPR.-FOR: CHIEF, ENGINEERING DIVISION

PREPARED UNDER THE DIRECTION OF JOHN N. REESE, COL. CORPS OF ENGINEERS, U.S.A. DISTRICT ENGINEER

Symbol	Description	Date	Approved

DATE:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

Designed by: K. Tab
Drawn by: E.C.
Prepared by: Civil Design Section
Submitted by: Ch. Dsn. & Studies Sec.

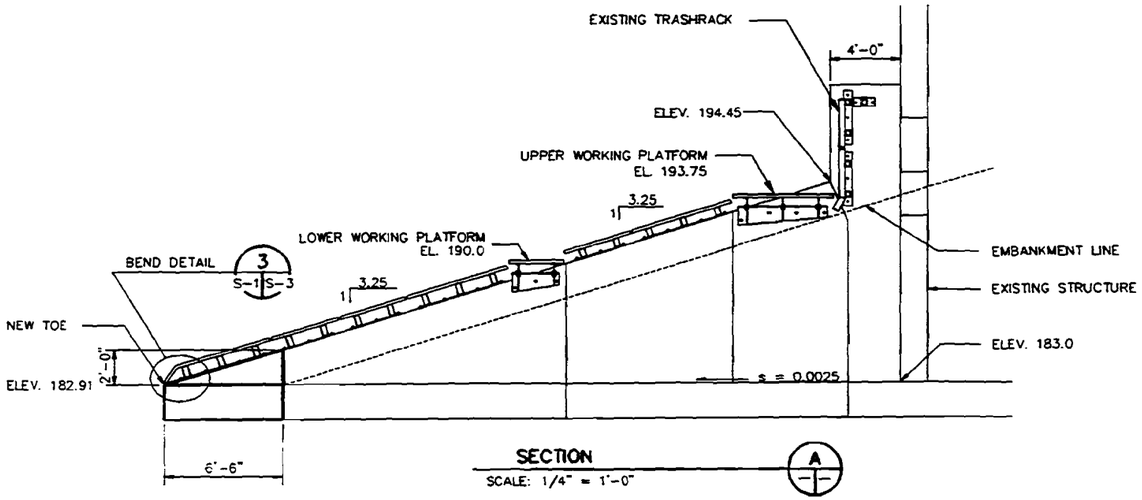
Date: 08 JAN. 85
Design file no.: M12-09-029
SPEC. No.: 8807
File name:
Plot date: JAN. 96
Plot scale: 1:1

REV.

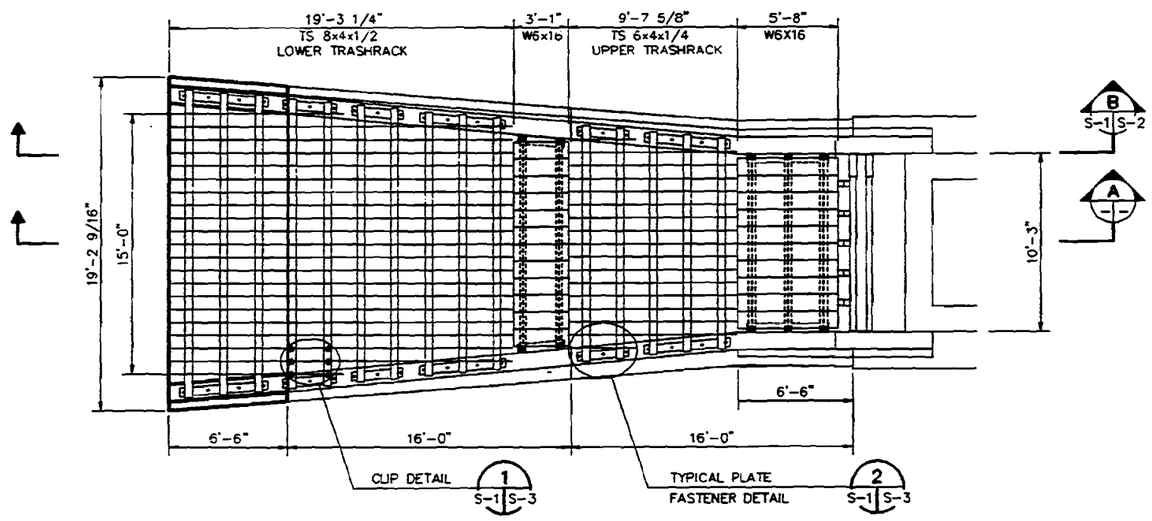
MERCED CO.
MERCED COUNTY STREAMS
CANAL CREEK, CA.
CASTLE DAM AND RESERVOIR
TRASHRACK MODIFICATION
CALIFORNIA

Sheet reference number:
G1
Sheet of

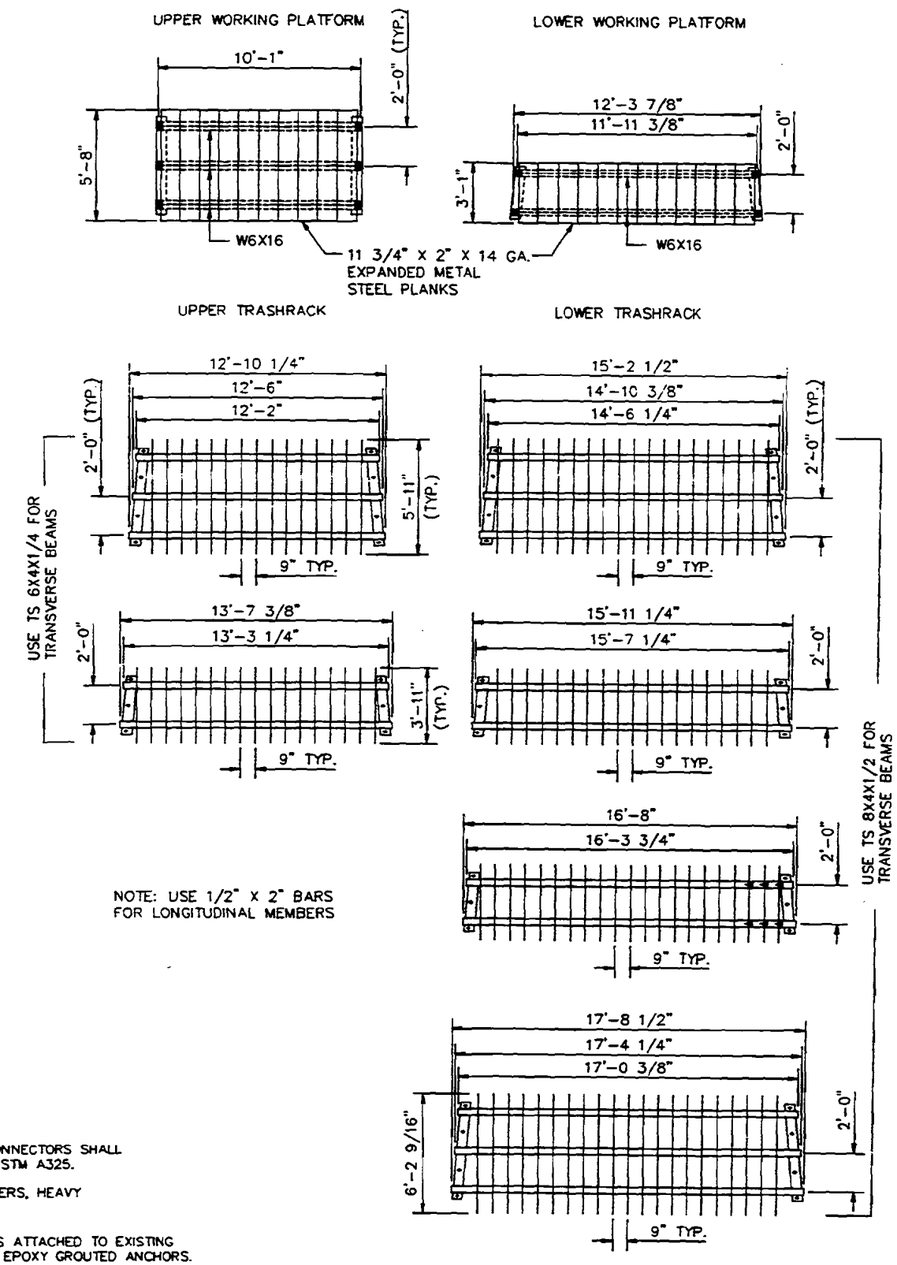
PLATE G7



SECTION
SCALE: 1/4" = 1'-0"



PLAN
SCALE: 1/4" = 1'-0"



NOTE: USE 1/2" X 2" BARS
FOR LONGITUDINAL MEMBERS

GENERAL NOTES:

1. ALL STRUCTURAL CONCRETE SHALL USE TYPE II PORTLAND CEMENT AND HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
2. LEAN MIX FOUNDATION CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 2,000 PSI
3. ALL REINFORCING STEEL TO BE GRADE 60.
4. ALL STRUCTURAL STEEL SHALL BE ASTM A36 WELDING QUALITY UNLESS OTHERWISE NOTED.
5. ALL STRUCTURAL TUBING TO BE ASTM A501 STEEL.
6. WORKMANSHIP AND TECHNIQUES FOR WELDING SHALL CONFORM TO THE REQUIREMENTS OF AWS D1.1.
7. ALL PARTS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION, CONFORMING TO ASTM A123.
8. ALL BOLTS, ANCHOR BOLTS, AND CONNECTORS SHALL BE GALVANIZED AND CONFORM TO ASTM A325.
9. ALL BOLTS SHALL HAVE LOCK WASHERS, HEAVY SPRING TYPE, GALVANIZED.
10. ALL BACKING PLATES AND BRACKETS ATTACHED TO EXISTING APPROACH CHANNEL USE 3/4" DIA. EPOXY GROUTED ANCHORS.
11. ALL BACKING PLATES ATTACHED TO NEW WALL USE 3/4" DIA. ANCHORS.
12. LOCATION OF ANCHOR BOLTS SHALL BE FIELD VERIFIED BEFORE INSTALLING TRASHRACK.
13. STEEL PLANKS AND ALL ATTACHING HARDWARE SHALL BE PRE-GALVANIZED.
14. ALL HOLES NECESSARY FOR ATTACHING COMPONENTS TOGETHER TO BE DRILLED PRIOR TO GALVANIZING.

GRAPHIC SCALE
SCALE: 1/4"=1'-0"
0 4' 8' 12' 16' 20'

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by	Date
K. Tolo	08 JAN. 93
Dwn by	Ckd by	Design file no.
E.E.	J.W.	M012-08-020
Reviewed by	SPKD. No.
J.W. WHITE	9607
Submitted by	File name
JV/ J. White	File date JAN. 93
Chief, Struct. Des. Sec.	Plot scale 1:1

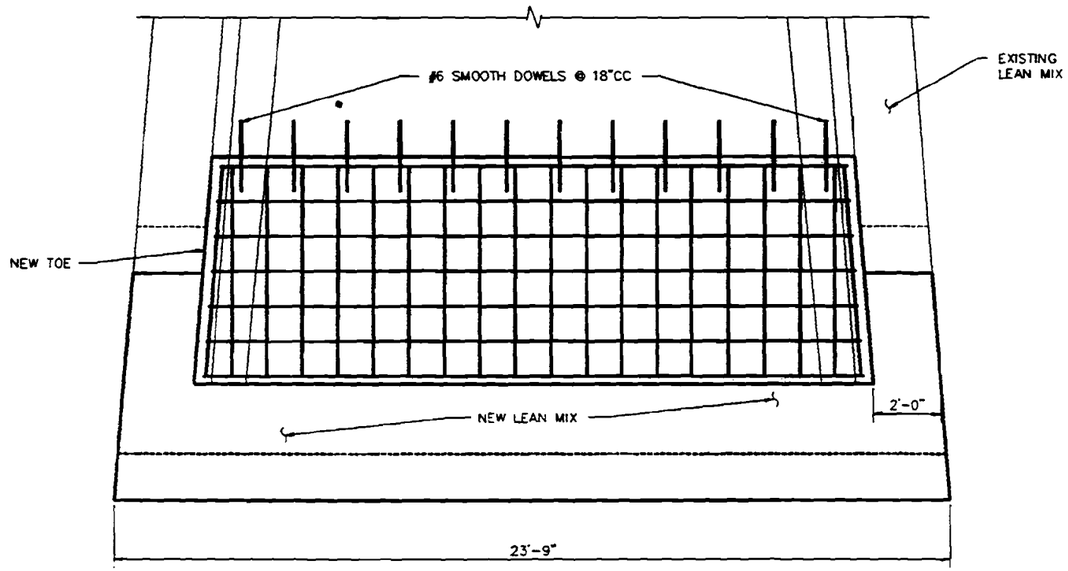
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED CO. CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CA.

CASTLE DAM AND RESERVOIR
TRASHRACK MODIFICATION
PLANS, SECTION, & GENERAL NOTES

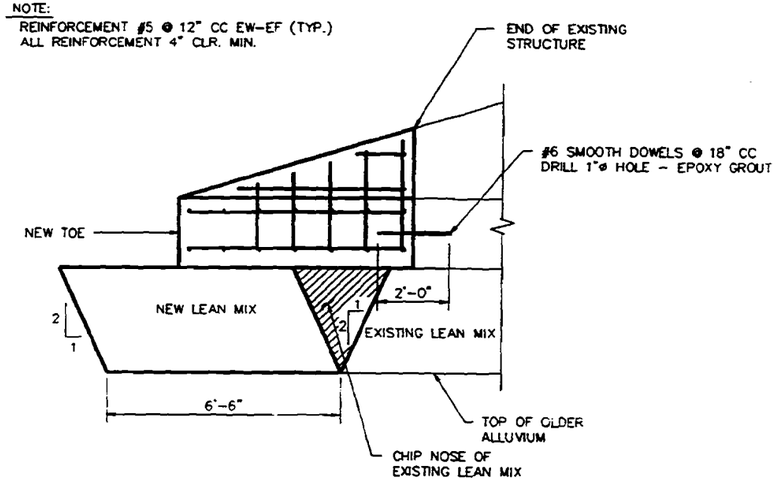
Sheet reference number:
S1
Sheet of

PLATE 68



CONCRETE TOE PLAN

NOTE:
REINFORCEMENT #5 @ 12" CC EW-EF (TYP.)
ALL REINFORCEMENT 4" CLR. MIN.

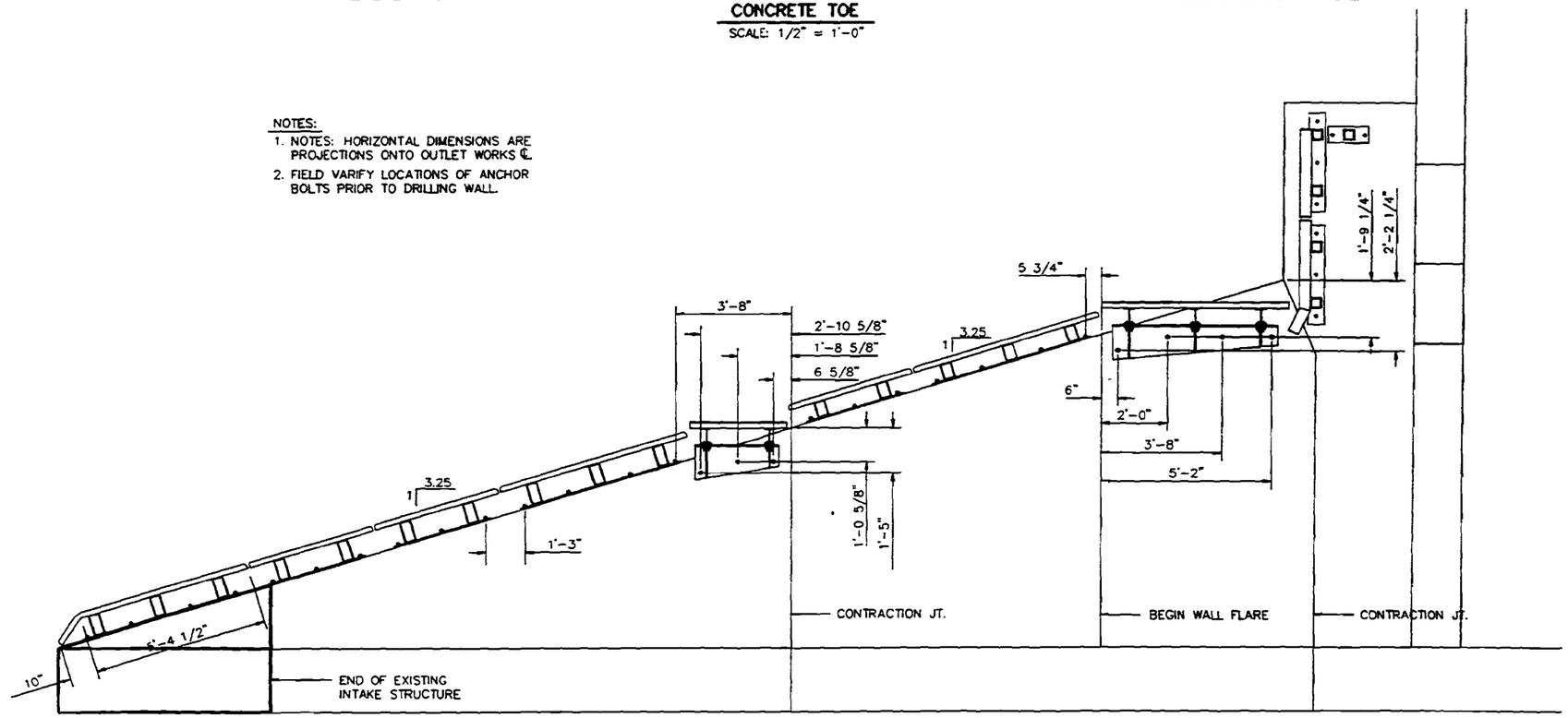


CONCRETE TOE ELEVATION

CONCRETE TOE

SCALE: 1/2" = 1'-0"

NOTES:
1. NOTES: HORIZONTAL DIMENSIONS ARE PROJECTIONS ONTO OUTLET WORKS ℄.
2. FIELD VARIFY LOCATIONS OF ANCHOR BOLTS PRIOR TO DRILLING WALL.



SECTION

SCALE: 1/2" = 1'-0"

B
S-1 | S-2

GRAPHIC SCALES

SCALE: 1/2"=1'-0"

0 1' 2' 3' 4' 6' 8' 10'

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: K. Yeats
Dwn by: E.E.
Ckd by: J.W.
Reviewed by: J.W. WHITE
Submitted by: D.A. Wade
Date: 08 JAN. 95
Design file no.: M12-09-028
Spec. No.: 0107
File name:
Plot date: JAN. 95
Plot scale: 1:1
Rev.

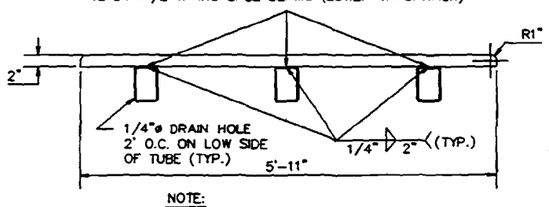
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED CO. CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CA.
CASTLE DAM AND RESERVOIR
TRASHRACK MODIFICATION
SECTION AND REINFORCEMENT

Sheet reference number:
S2
Sheet of

PLATE 60

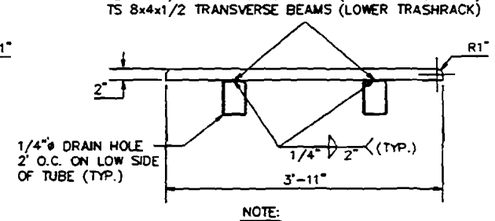
NOTE:
TS 6x4x1/4 TRANSVERSE BEAMS (UPPER TRASHRACK)
TS 8x4x1/2 TRANSVERSE BEAMS (LOWER TRASHRACK)



NOTE:
1/2"x2"x5'-11" BAR
34 REQUIRED

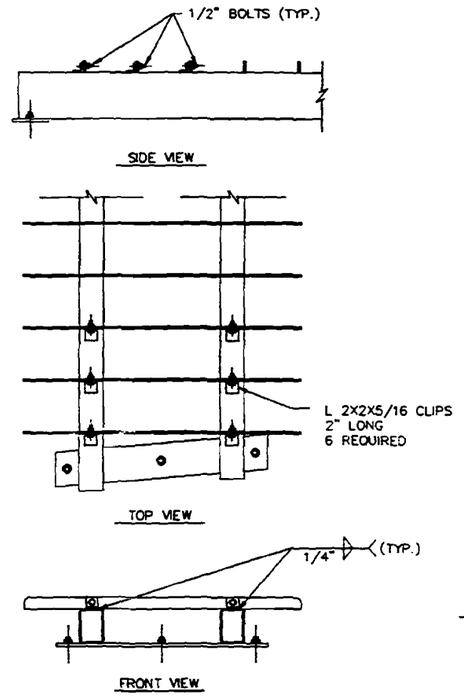
BAR DETAIL (TYP.)
SCALE: 1" = 1'-0"

NOTE:
TS 6x4x1/4 TRANSVERSE BEAMS (UPPER TRASHRACK)
TS 8x4x1/2 TRANSVERSE BEAMS (LOWER TRASHRACK)

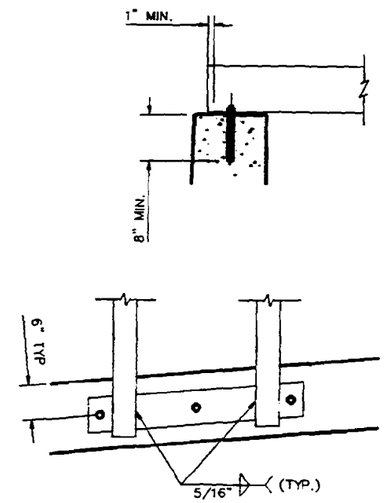


NOTE:
1/2"x2"x3'-11" BAR
57 REQUIRED

BAR DETAIL (TYP.)
SCALE: 1" = 1'-0"

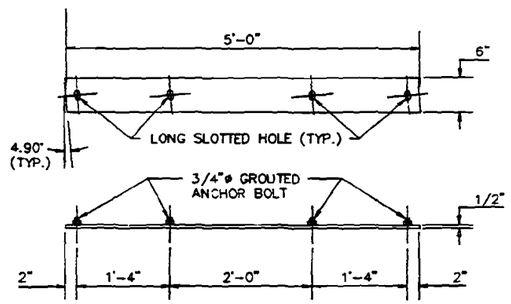


CLIP DETAIL 1 S-1 S-3
SCALE: 1" = 1'-0"



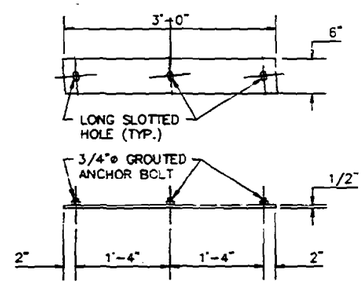
NOTE:
ANCHOR BOLTS SHALL BE CHEMICALLY ANCHORED IN PREDRILLED HOLES USING POLYESTER RESIN GROUT ACCORDING TO MANUFACTURER'S INSTRUCTIONS. DRILL HOLES SHALL BE BLOWN DRY IMMEDIATELY PRIOR TO INSERTION OF GROUT AND ANCHOR.

TYPICAL PLATE FASTENER DETAIL 2 S-1 S-3
SCALE: 1" = 1'-0"



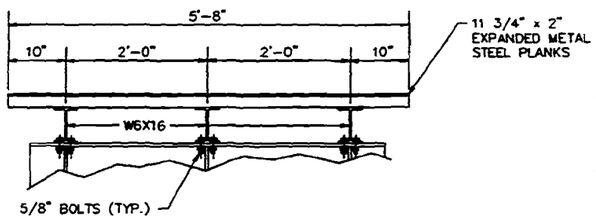
NOTE:
1/2"x6"x5' STEEL PLATE
6 REQUIRED

PLATE DETAIL (TYP.)
SCALE: 1" = 1'-0"



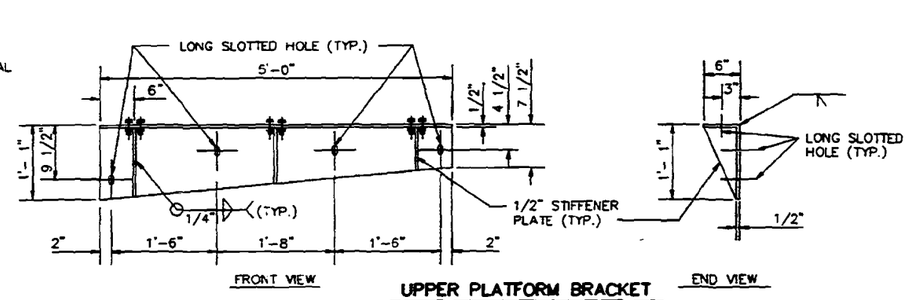
NOTE:
1/2"x6"x3' STEEL PLATE
6 REQUIRED

PLATE DETAIL (TYP.)
SCALE: 1" = 1'-0"

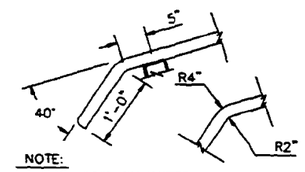


UPPER PLATFORM
SCALE: 1" = 1'-0"

NOTE:
ATTACH PLANKS TO WIDE FLANGE SECTIONS WITH 5/16" CARRIAGE BOLTS AS PER MANUFACTURER RECOMMENDATIONS.

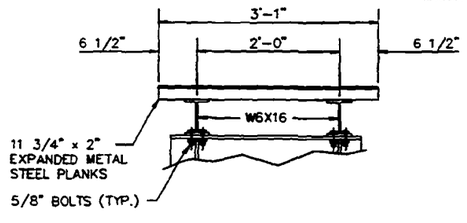


UPPER PLATFORM BRACKET
SCALE: 1" = 1'-0"

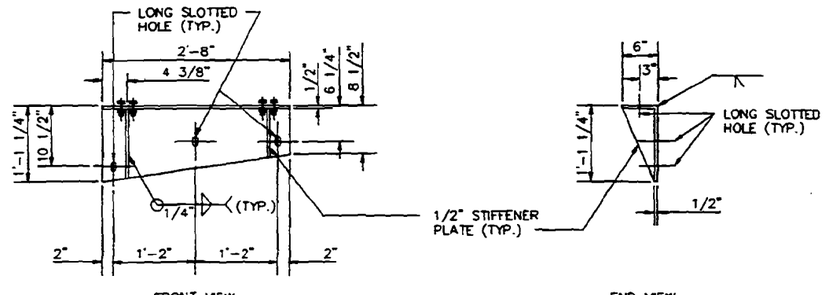


NOTE:
BAR BEND ON BOTTOM RACK ONLY.
1/2"x2"x6'-2 1/2"
21 REQUIRED

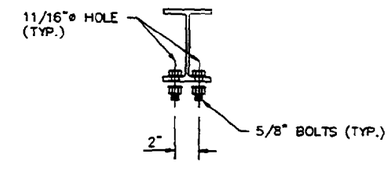
BEND DETAIL 3 S-1 S-3
SCALE: 1" = 1'-0"



LOWER PLATFORM
SCALE: 1" = 1'-0"



LOWER PLATFORM BRACKET
SCALE: 1" = 1'-0"



W6X16 DETAIL (TYP.)
NOT TO SCALE

GRAPHIC SCALE
SCALE: 1" = 1'-0"
0 1' 2' 3' 4' 5'

US Army Corps of Engineers
Sacramento District

Mark	Description	Date	Approved

Designed by: K. Fate
Drawn by: E.E.
Checked by: J.W.
Reviewed by: J.W. WHITE
Submitted by: G.A. Wade
Date: 08 JAN. 99
Design file no: MERS-08-020
SPEC. No.: 8807
File name:
Plot date: JAN. 99
Plot scale: 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

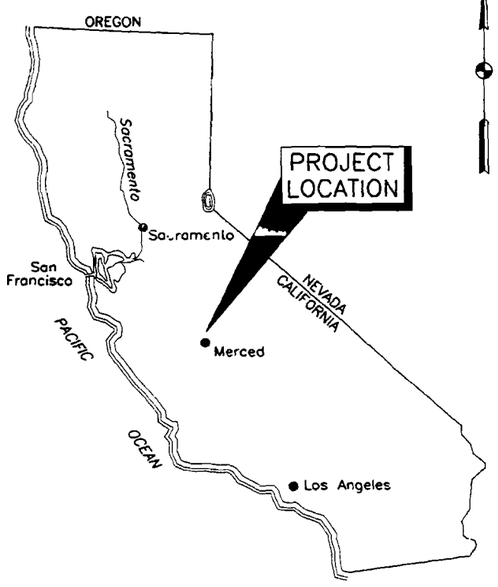
MERCED CO. CALIFORNIA
MERCED COUNTY STREAMS
CANAL CREEK, CA.
CASTLE DAM AND RESERVOIR
TRASHRACK MODIFICATION
TYPICAL DETAILS

Sheet reference number:
S3
Sheet of

PLATE 70

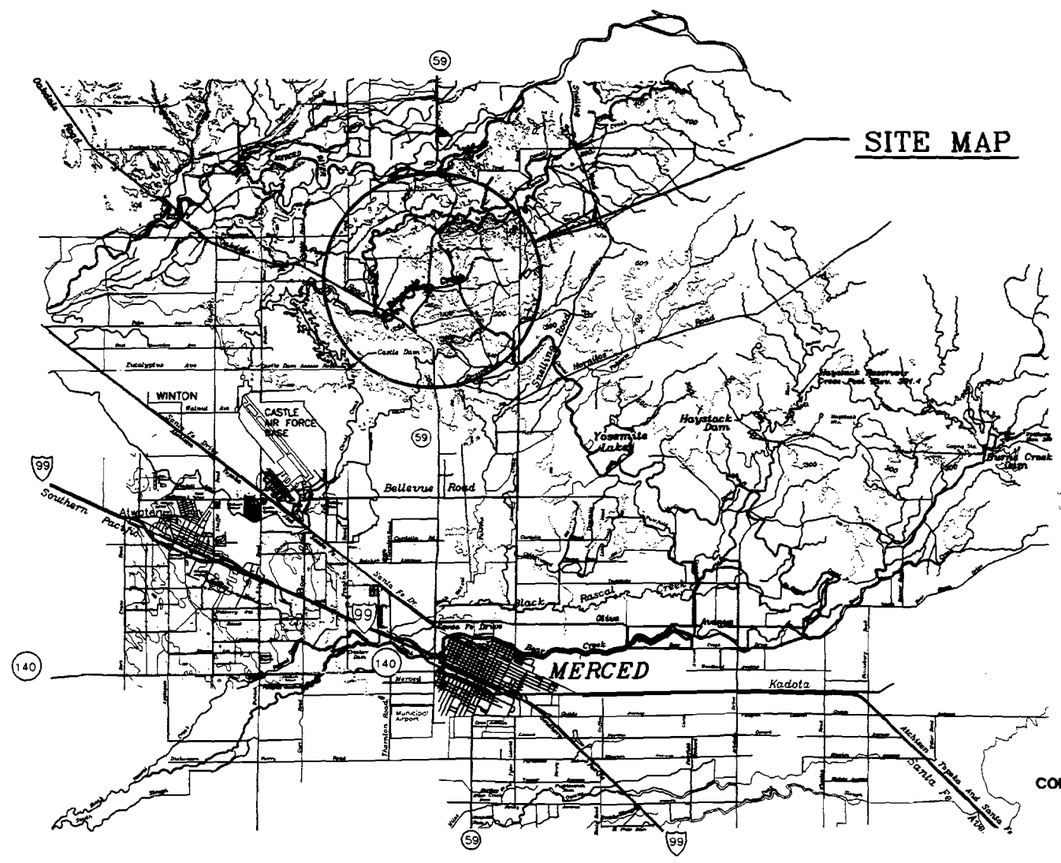
US Army Corps
of Engineers
Sacramento District

MERCED STREAMS GROUP
EDENDALE CREEK
CHANNEL MODIFICATIONS AT HIGHWAY 59 BRIDGE



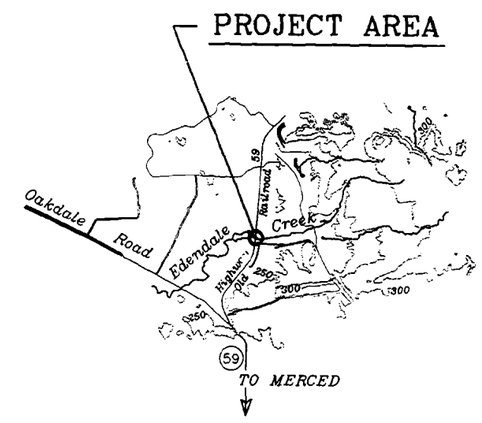
VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE



SITE MAP

NOT TO SCALE

AS-BUILT
CONTRACT NO. 98-P-0168

Schedule Of Drawings

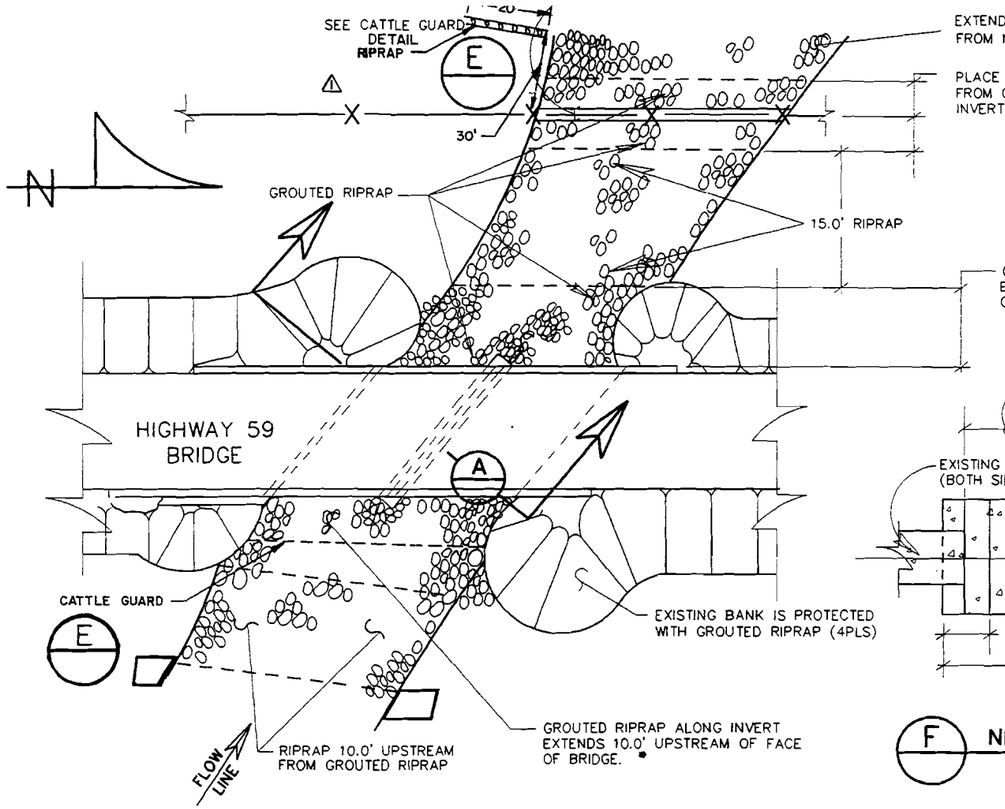
1	*Title Sheet, Location Map, and Schedule Of Drawings*
2	*Site Plan, Section, Details and General Notes*

Drawn by H.M.	Designed by T.WEEKS
Design File No. ME-3-165	Spec No. 9961
Plot Date 12/11/97	File None
	N/A

Approved Functional Adequacy /s/ J.MACK 12/15/97 Date
Chief, Civil Design Branch
Prepared by SACRAMENTO DISTRICT CIVIL DESIGN BRANCH
/s/ R.MULLER 12/15/97 Date
Chief, Design & Studies Section

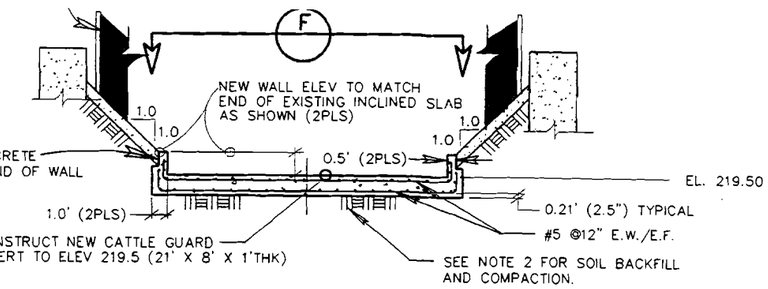
MERCED CALIFORNIA
MERCED STREAMS GROUP
EDENDALE CREEK
CHANNEL MODIFICATIONS AT HIGHWAY 59 BRIDGE
TITLE SHEET, LOCATION MAP, AND SCHEDULE OF DRAWINGS

Sheet reference number:
1
1_OF_2



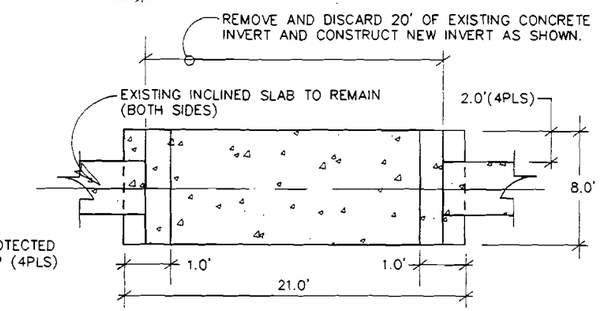
SITE PLAN

NOT TO SCALE



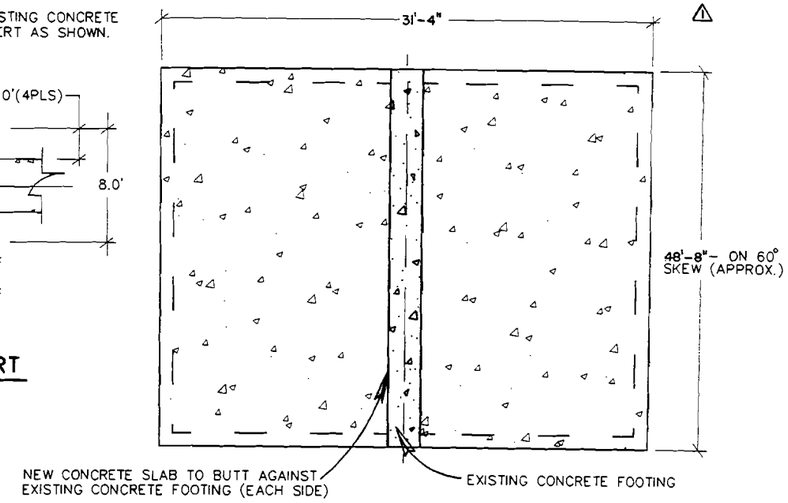
E CATTLE GUARD DETAIL

NOT TO SCALE



F NEW CATTLE GUARD INVERT

NOT TO SCALE

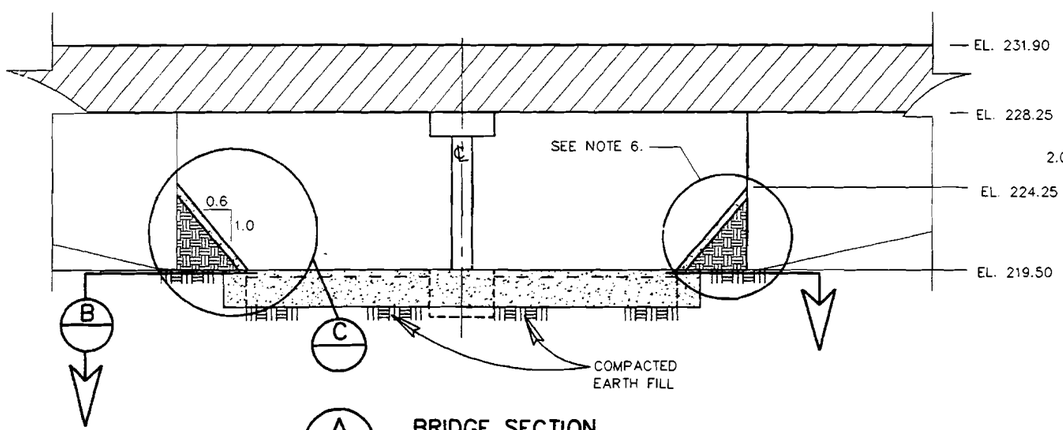


B TYPICAL SECTION - CONCRETE INVERT

NOT TO SCALE

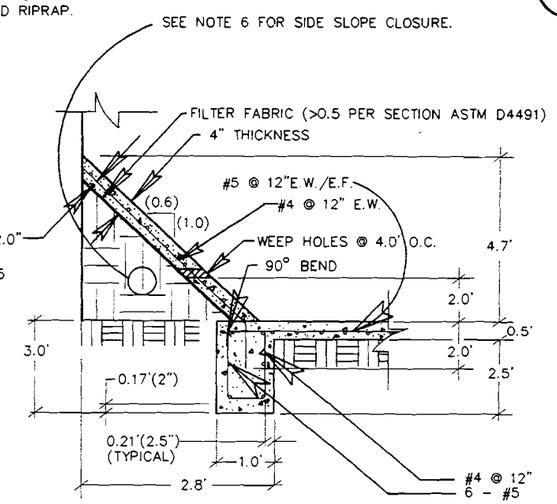
NOTES:

1. THE GROUTED RIPRAP EXISTING ON BOTH THE UPSTREAM AND DOWNSTREAM ROAD EMBANKMENTS IS TO REMAIN.
2. DEMOLISH EXISTING GROUTED RIPRAP: 1a) BENEATH THE HIGHWAY 59 BRIDGE, 2b) WITHIN THE STREAMBED, UPSTREAM AND DOWNSTREAM ALONG THE FACE OF THE BRIDGE INVERT (2PLS). ESTIMATED AMOUNT OF EXISTING GROUTED RIPRAP FROM 2a AND 2b IS APPROXIMATELY 120 TONS.
3. STOCKPILED DEMOLISHED GROUTED RIPRAP SHALL BE REUSED AS RIPRAP AND SHALL BE BROKEN DOWN BEFORE PLACEMENT NOT TO EXCEED 18" DIAMETER.
4. EXISTING CONCRETE FOOTING ALONG AXIS OF BRIDGE MUST NOT BE DISTURBED.
5. DISCARD OFF SITE ALL SMALL CONCRETE RUBBLE LESS THAN 4" IN DIAMETER.
6. SECURE ALL SIDE SLOPE ENDS (4) BENEATH THE BRIDGE FACING UPSTREAM AND DOWNSTREAM WITH GROUTED RIPRAP.



A BRIDGE SECTION

NOT TO SCALE



C TYPICAL DETAIL

NOT TO SCALE

AS-BUILT

NOTES:

1. SOIL DISPOSITION: THE CONTRACTOR SHALL BACKFILL THE AREAS REFERENCED IN NOTE 2 TO PREVENT FOUNDATION FAILURE. THE EXCAVATION SHALL BE BACKFILLED WITH THE ORIGINALLY EXCAVATED SOIL. THE EXCAVATION SHALL THEN BE LINED WITH FILTER FABRIC USING ASTM D4491 AND CLEAN FILL SHALL BE USED TO BRING THE EXCAVATION TO EXISTING GRADE. THE CONTRACTOR SHALL PROVIDE ALL CLEAN FILL FROM COMMERCIAL SOURCES.
2. SOIL COMPACTION: THE CONTRACTOR SHALL BACKFILL THE EXCAVATION AS DESCRIBED IN NOTE 1. FILL SHALL BE PLACED IN LOOSE LIFTS THICKNESS OF 6"- INCHES OR LESS. EACH LAYER SHALL BE COMPACTED TO NOT LESS THAN 95 PERCENT OF MAXIMUM DENSITY (ASTM 1557). ADDITIONAL CLEAN FILL MAY ALSO BE REQUIRED TO COMPLETE BACKFILLING CLEAN FILL FROM COMERCIAL RESOURCES. THE FOLLOWING AREAS SHALL CONFORM TO THESE NOTES AND ALSO COMPLY WITH COMPACTION/DENSITY TEST STANDARDS IN ACCORDANCE WITH ASTM-D-1556 AND ASTM-D-1557.
   - 2a. THE INVERT BENEATH THE BRIDGE.
   - 2b. THE GROUTED RIPRAP UPSTREAM AND DOWNSTREAM OF FACE OF BRIDGE INVERT (20' TOTAL).
   - 2c. THE CATTLE GUARD INVERT
   - 2d. THE GROUTED RIPRAP UPSTREAM AND DOWNSTREAM OF FACE OF CATTLE GUARD INVERT (10' TOTAL).
3. CONSTRUCTION DEBRIS: THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL CONSTRUCTION DEBRIS, AND ALL OTHER DEBRIS RESULTING FROM WORK OUTLINED IN THE PLANS AND SPECIFICATIONS.

of Engineers
Sacramento District

Symbol	Description	Date Approved	Symbol	Description	Date Approved
A	REVISED AS-BUILT	2/10/00			

Designed by: T.WEEKS
Dwn by: H.M.
Ckd by: R.MULLER
Reviewed by: R.MULLER
Submitted by: SECT. CHIEF R.MULLER
Date: 12/11/97
Rev.
Design file no: ME-3-165
SPEC. No.: 9961
File name:
Plot date: 12/11/97
Plot scale: NTS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

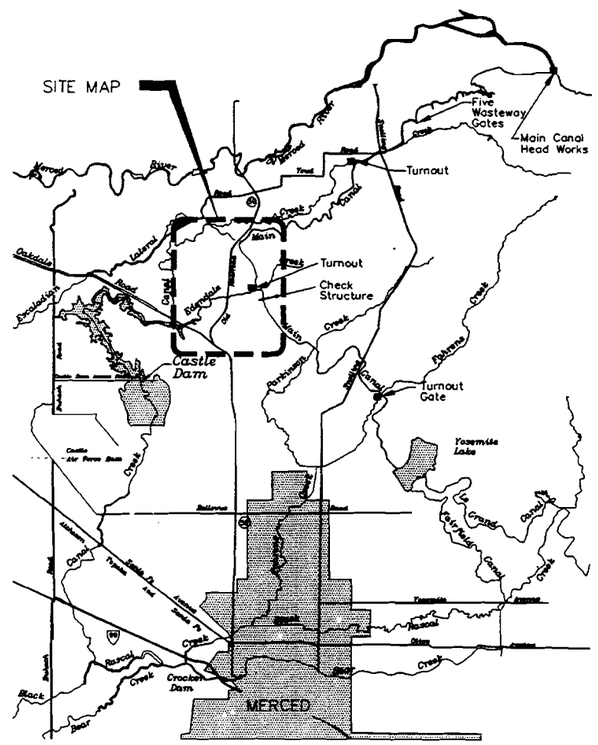
CIVIL DESIGN BRANCH
DESIGN & STUDIES SECTION

MERCED CALIFORNIA
MERCED_STREAMS_GROUP
EDENDALE_CREEK
SITE_PLANS,SECTIONS,DETAILS AND_GENERAL_NOTES

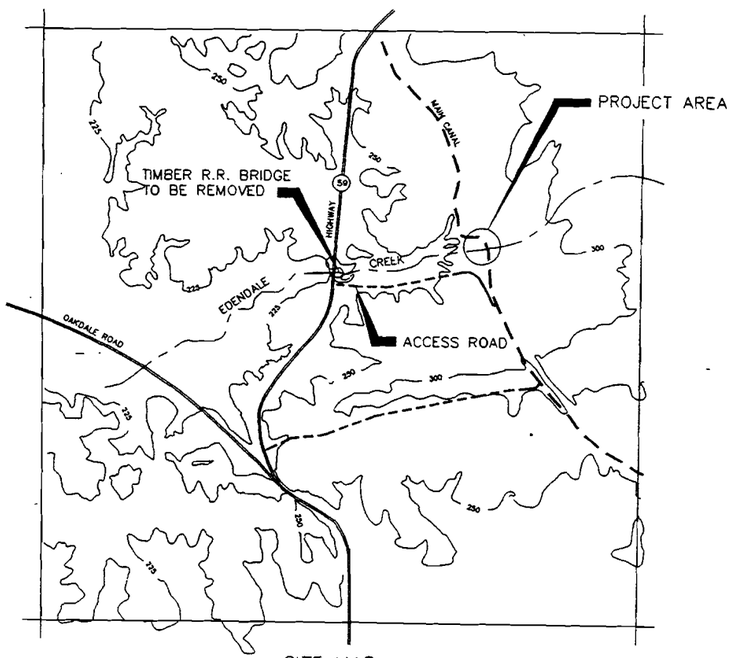
Sheet reference number:
SHT_2
2_OF_2

MERCED STREAMS GROUP
EDENDALE CREEK
NEW TURNOUT STRUCTURE AND WEIR

VICINITY MAP
NOT TO SCALE



LOCALITY MAP
NOT TO SCALE



SITE MAP
NOT TO SCALE

AS-CONSTRUCTED
CONTRACT NO. 98-C-0006

Approved
Chief, Engineering Division — Date
Prepared Under the Direction of
Col. Corps of Engineers — District Engineer

Approval Recommended
Chief, Civil Design Branch — Date
Drawn by: G. Bucknell
Design File No.: ME-04-164

Approved Functional Adequacy
Chief, Design and Studies Sec. — Date
Designed by: K. Tate/C. Wong
Spec No.: 9743

Prepared by
SACRAMENTO DISTRICT
CIVIL DESIGN BRANCH
Chief, Structural Design Section — Date

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
NEW TURNOUT STRUCTURE AND WEIR
COVER SHEET, LOCATION MAPS,
AND SCHEDULE OF DRAWINGS

Sheet reference number:
G-1
Sheet 1 of 15

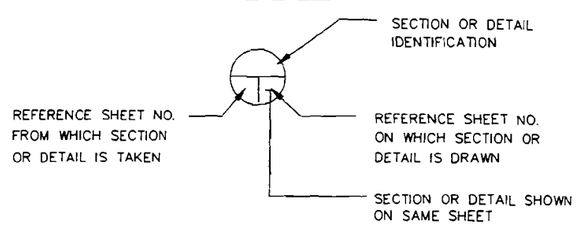
C:\PROJECTS\EDENDALE\EDEN-G1 12/03/98 12:59

SEQ. NO.	SHT. NO.	TITLE
		GENERAL
1	G-1	COVER SHEET, LOCATION MAPS AND SCHEDULE OF DRAWINGS
2	G-2	SCHEDULE OF DRAWINGS, ABBREVIATIONS, AND NOTES
		CIVIL
3	C-1	NEW TURNOUT STRUCTURE AND WEIR – GENERAL LAYOUT PLAN
4	C-2	NEW TURNOUT STRUCTURE AND WEIR – NEW CHANNEL ALIGNMENT AND EMBANKMENT PLAN
5	C-3	NEW TURNOUT STRUCTURE – EXCAVATION AND BACKFILL PLAN AND SECTIONS
6	C-4	NEW TURNOUT STRUCTURE AND WEIR – PROFILE AND TYPICAL SECTIONS
		STRUCTURAL
7	S-1	NEW TURNOUT STRUCTURE – PLAN AND ELEVATIONS
8	S-2	NEW TURNOUT STRUCTURE – SECTIONS AND DETAILS – GENERAL STRUCTURAL NOTES
9	S-3	NEW TURNOUT STRUCTURE – REINFORCING SECTIONS
10	S-4	NEW TURNOUT STRUCTURE – REINFORCING SECTIONS
11	S-5	NEW TURNOUT STRUCTURE – SLIDE GATE AND OPERATOR SUPPORT DETAILS
12	S-6	NEW TURNOUT STRUCTURE – HANDRAILING DETAILS
13	S-7	WEIR STRUCTURE – PLAN AND SECTION
14	S-8	WEIR STRUCTURE – SECTIONS AND DETAILS
15	S-9	WEIR STRUCTURE – REINFORCING DETAILS
⚠ 4A	C-2A	NEW TURNOUT STRUCTURE AND WEIR – TYPICAL BERM SECTIONS

ABBREVIATIONS

ACI	AMERICAN CONCRETE INSTITUTE
ALT.	ALTERNATE
APP., APPROX.	APPROXIMATE
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
L, Δ	ANGLE
B.M.	BENCH MARK
B.F.	BOTTOM FACE
CONST.	CONSTRUCTION
C.C.	CENTER-TO-CENTER
C.J.	CONSTRUCTION JOINT
℄	CENTERLINE
CLR.	CLEAR
CONC.	CONCRETE
CONTR.	CONTRACTION
db	BAR DIAMETER
DIA. ∅	DIAMETER
D/S	DOWNSTREAM
E	EAST
EA.	EACH
E.F.	EACH FACE
EL., ELEV., ELE.	ELEVATION
E.W.	EACH WAY
EXIST.	EXISTING
FT.	FOOT OR FEET
FTG.	FOOTING
G.B.	GRADE BREAK
GALV.	GALVANIZED
G.L.	GROUND LINE
H	HEIGHT
HORIZ.	HORIZONTAL
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
INV.	INVERT
JT.	JOINT
L	LENGTH
L.F.	LINEAR FEET
MAX.	MAXIMUM
MIN.	MINIMUM
MISC.	MISCELLANEOUS
N	NORTH
NO.	NUMBER
NTS	NOT TO SCALE
O.D.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
PERM.	PERMANENT
P.C.	POINT OF CURVATURE
P.I.	POINT OF INTERSECTION
PL., ℙ	PLATE
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RADIUS
REINF.	REINFORCING
REQ.	REQUIRED
S	SOUTH
SCH.	SCHEDULE
SECT.	SECTION
S.F.	SQUARE FOOT
SHT.	SHEET
SPEC.	SPECIFICATIONS
S.S.	STAINLESS STEEL
STA.	STATION
STR.	STRUCTURE
TEMP.	TEMPORARY
T.S.	STRUCTURAL TUBING
TYP.	TYPICAL
T.O.W.	TOP OF WALL
TRANS.	TRANSITION
U/S	UPSTREAM
UHMW-PE	ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE
VERT.	VERTICAL
W/	WITH

LEGEND



SECTION AND DETAIL CROSS REFERENCING CONVENTIONS

AS-CONSTRUCTED

of Engineers
Sacramento District

Symbol	Description	Date	Approved
⚠	REVISED AS-CONSTRUCTED	5/20/98	

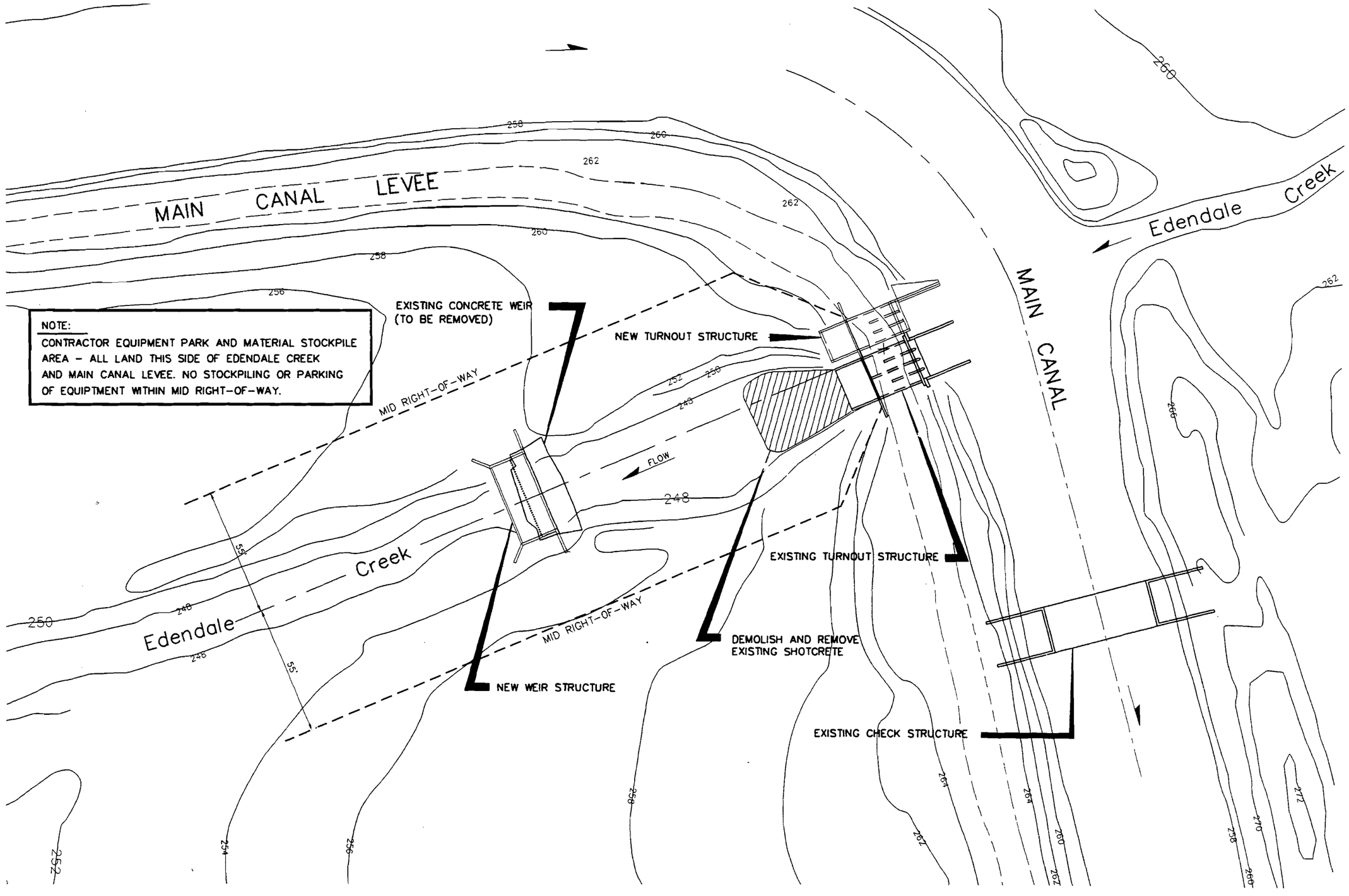
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

Designed by: K. Tate
Dwn by: G. Buckner
Ckd by: M. Rutford
Reviewed by: R. Norris
Submitted by:
Chief, Sir. el. Des. Sec.
Date: 15 JULY 1997
Rev
Design file no: 8743
SPEC. No.: ME-04-164
File name:
Plot date:
Plot scale: 1:1

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

SCHEDULE OF DRAWINGS
ABBREVIATIONS AND NOTES

Sheet reference number:
G-2
Sheet 2 of 15



PLAN

SCALE: 1" = 20'

AS-CONSTRUCTED

SCALE: 1"=20'

GRAPHIC SCALES

0 20' 40' 60' 80' 100'

of Engineers
Sacramento District

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved

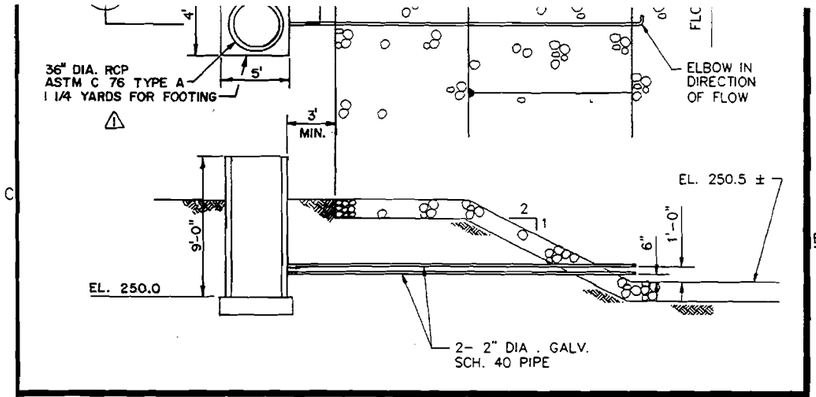
Designed by: K. Tate
Dwn by: E. Echeverria
Ckd by: M. Ruhland
Reviewed by: R. Norris
Submitted by: Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Design file no: MC-04-164
SPEC No.: 8743
Fax name:
Plot date:
Plot scale: 1:1
Rev

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

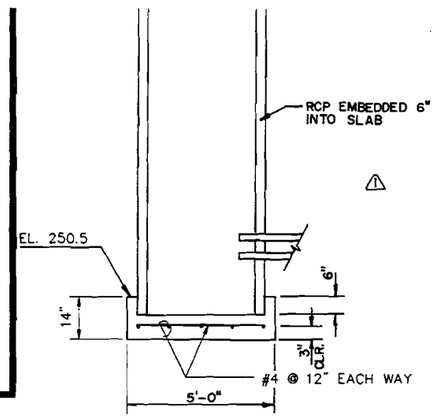
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
CALIFORNIA

NEW TURNOUT STRUCTURE AND WEIR
GENERAL LAYOUT PLAN

Sheet reference number:
C-1
Sheet 3 of 15



DETAIL 1
SCALE: 1" = 5'



SECTION E
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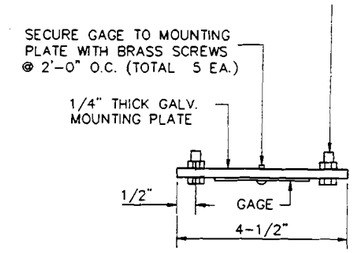
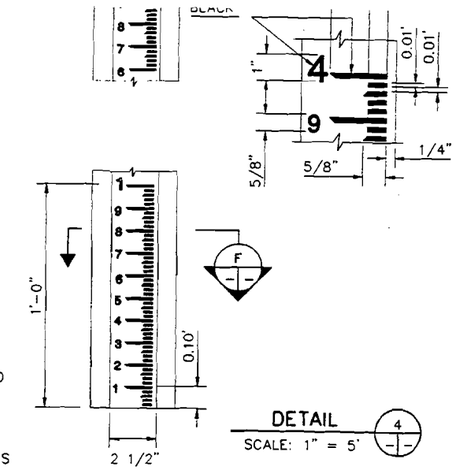


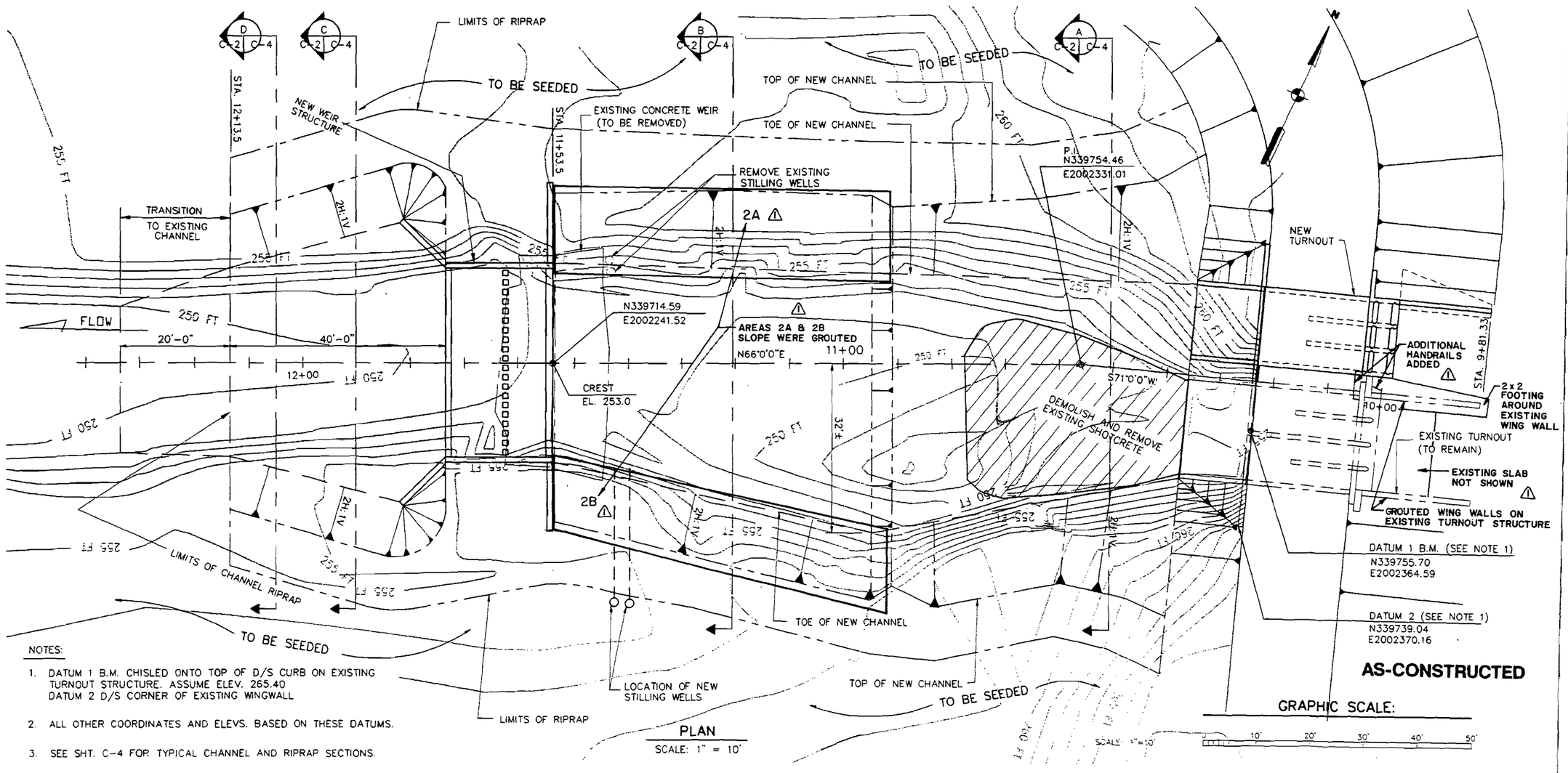
SECTION F
SCALE: 1" = 5'

NOTES:

1. MATERIAL SHALL BE 18 GAGE (U.S. STANDARD) METAL COATED WITH SUBSTANTIAL THICKNESS OF PORCELAIN ENAMEL FINISH.
2. FACE OF GAGE SHALL BE WHITE WITH SOLID BLACK NUMBERS AND GRADUATIONS.
3. GRADUATIONS SHALL BE SHARP AND ACCURATE TO DIMENSIONS SHOWN.



DETAIL 4
SCALE: 1" = 5'



NOTES:

1. DATUM 1 B.M. CHISLED ONTO TOP OF D/S CURB ON EXISTING TURNOUT STRUCTURE. ASSUME ELEV. 265.40
   DATUM 2 D/S CORNER OF EXISTING WINGWALL
2. ALL OTHER COORDINATES AND ELEVS. BASED ON THESE DATUMS.
3. SEE SHT. C-4 FOR TYPICAL CHANNEL AND RIPRAP SECTIONS.

PLAN
SCALE: 1" = 10'

Sacramento District

Symbol	Description	Date	Approved
1	REVISED AS CONSTRUCTED	3/26/99	

Designed by: K. Tate
Dwn by: G. Buckner
Ckd by: M. Rutherford
Reviewed by: R. Norris
Submitted by:
Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Design file no: ME-04-164
SPEC. No: 9743
File name:
Plot date:
Plot scale: 1:1
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

NEW TURNOUT STRUCTURE AND WEIR
NEW CHANNEL ALIGNMENT
AND EMBANKMENT PLAN

Sheet reference number:
C-2
SHEET 4 OF 15

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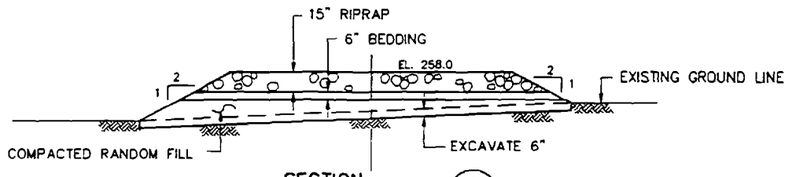
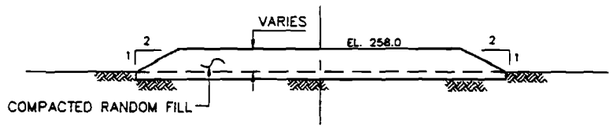


SECTION G
SCALE: 1"= 5'-0"



SECTION F
SCALE: 1" = 5'-0"

△1 TYPICAL BERM SECTIONS

AS-CONSTRUCTED

REVISION	DATE		BY	SP
△1	3/30/99	REVISED AS-CONSTRUCTED	DCS	DF

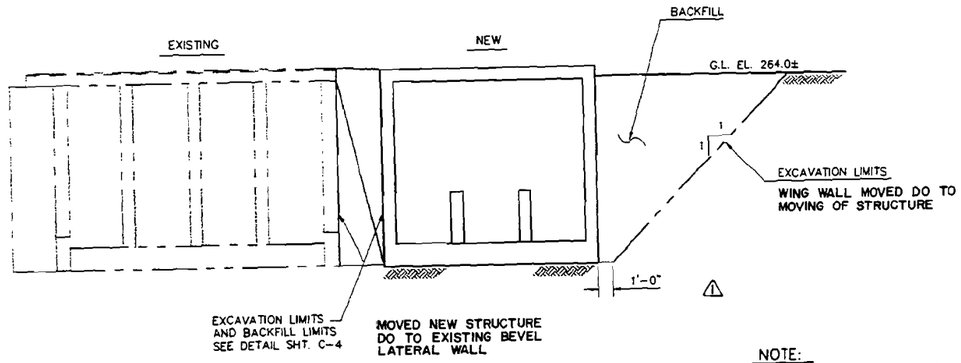
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED:
DRAWN:
CHECKED:
SUBMITTED: DATE APPROVED

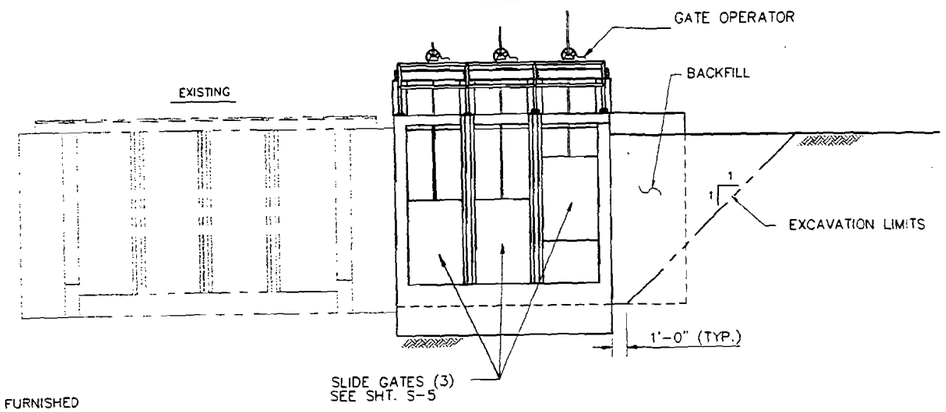
MERCED COUNTY CALIFORNIA
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
NEW TURNOUT STRUCTURE AND WEIR
NEW CHANNEL ALIGNMENT
AND EMBANKMENT PLAN

SCALE AS NOTED | SPEC. No. 9743
SHEET C-2.2A 9A of 15 | FILE No. ME-04-164

SAFETY DAYS

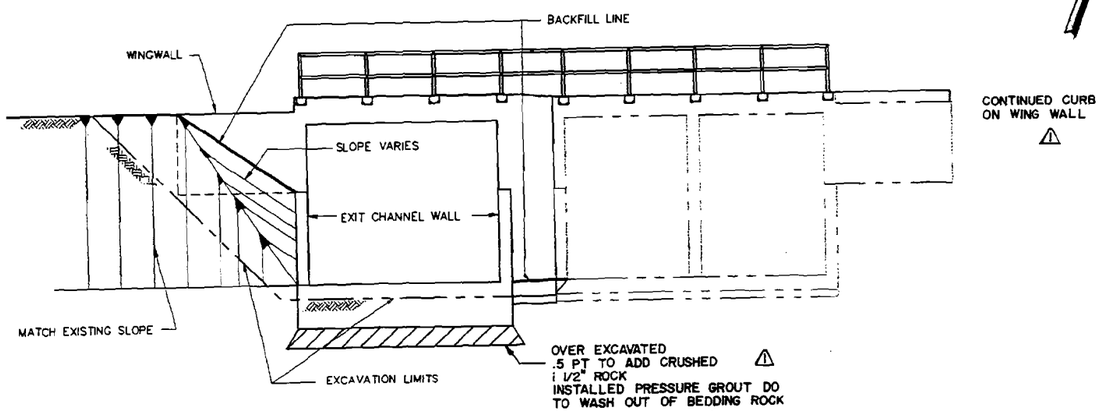


SECTION B
SCALE: 1" = 5'



NOTE:
GATE OPERATORS TO BE FURNISHED AND INSTALLED BY MERCED IRRIGATION DISTRICT

SECTION A
SCALE: 1" = 5'



SECTION C
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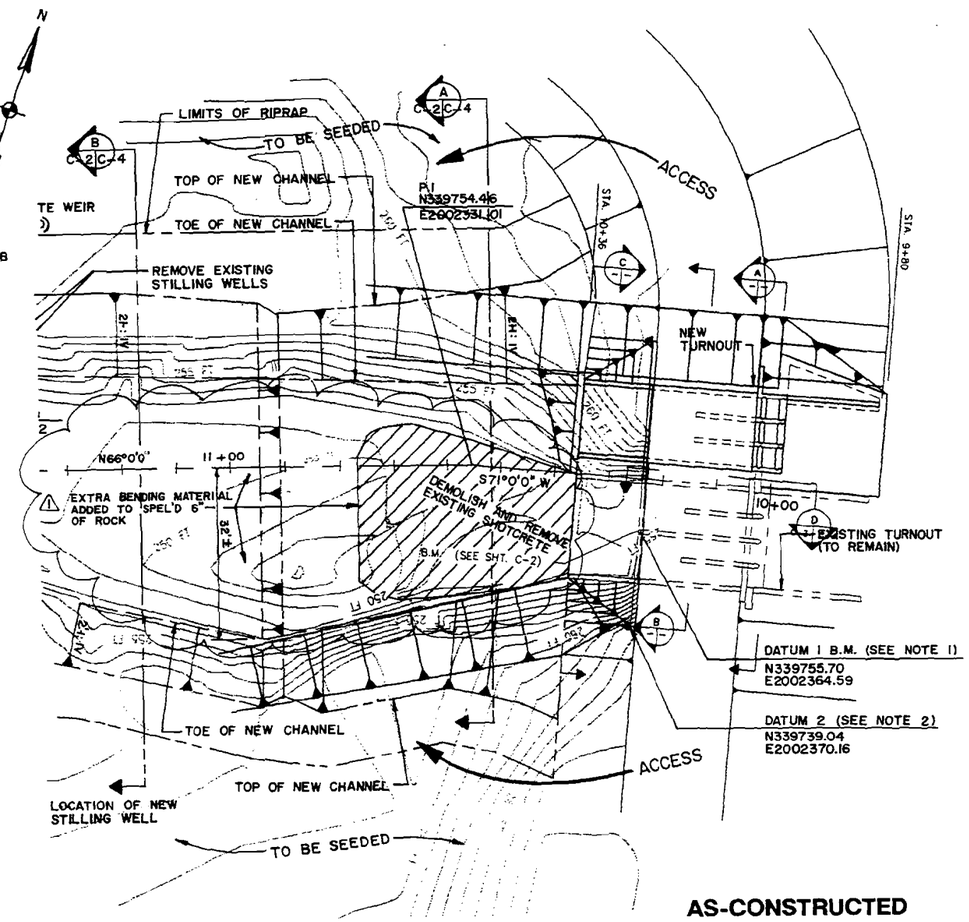

AS-CONSTRUCTED

EXCAVATION PLAN
SCALE: 1" = 10'

NOTE:
SLOPE BACKFILL TO TOP OF EXIT CHANNEL WALL FROM LINE CONNECTING OUTER EDGE OF WINGWALL TO D/S END OF EXIT CHANNEL WALL. SEE PLAN SHT. C-2.

GRAPHIC SCALES

SCALE: 1"=5'
0 5' 10' 15' 20' 25'

SCALE: 1"=10'
0 10' 20' 30' 40' 50'

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	9/30/96	

of Engineers
Sacramento District

Designed by: K. Tate
Dwn by: G. Buckner
Ckd by: M. Rutford
Reviewed by: R. Norris
Submitted by: Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Rev.
Design file no: UE-01-164
SPEC. No: 9743
Tree name:
Plot date:
Plot scale: 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

NEW TURNOUT STRUCTURE
EXCAVATION AND BACKFILL
PLAN AND SECTIONS

Sheet reference number:
C-3
SHEET 5 OF 15

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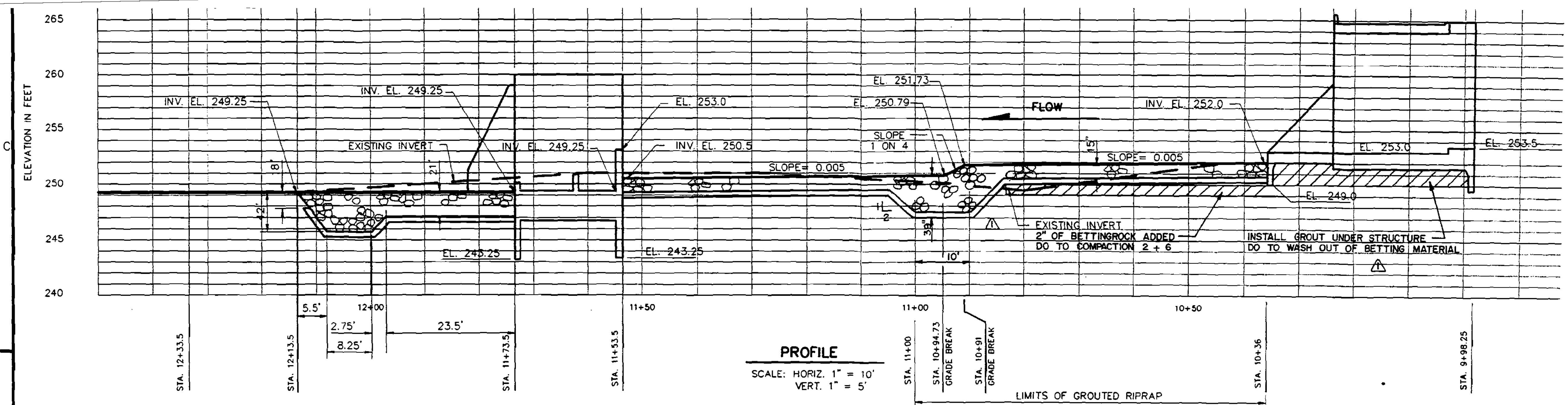
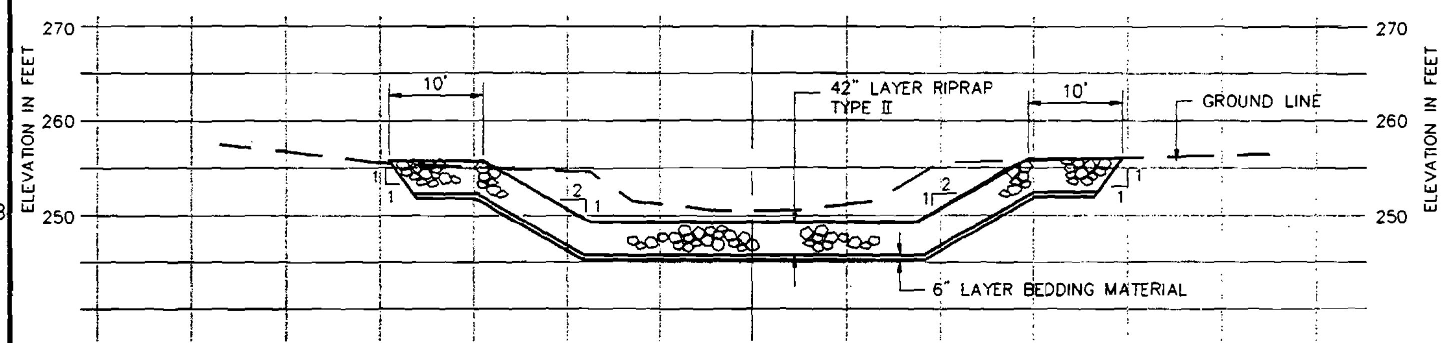


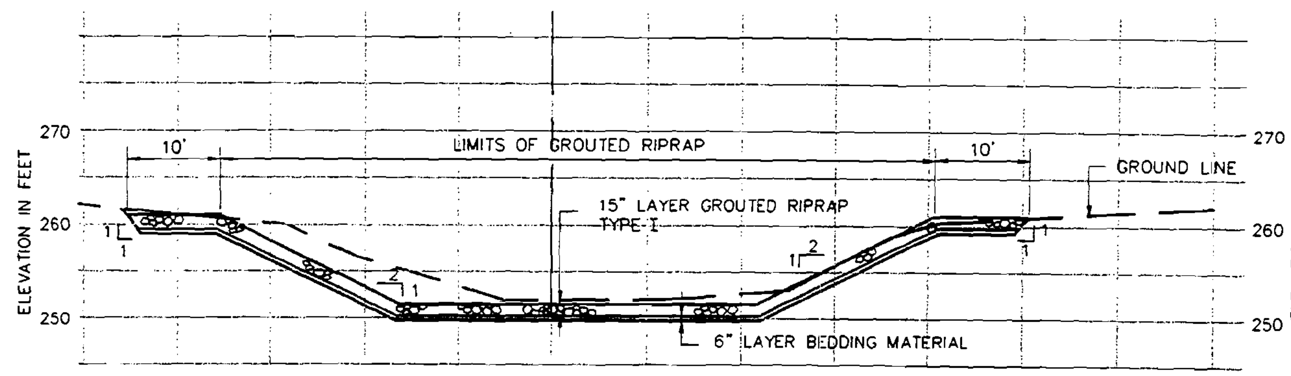
PROFILE

SCALE: HORIZ. 1" = 10'
VERT. 1" = 5'



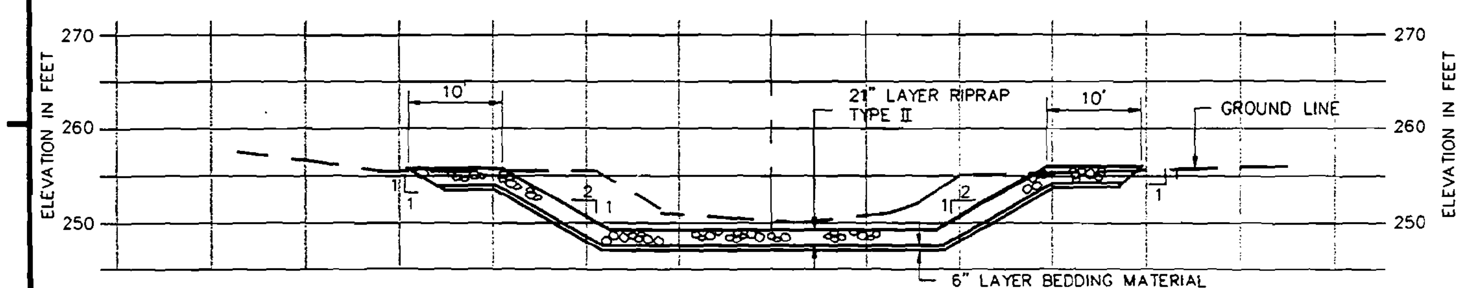
SECTION ⊙ STA. 12+05 (D, C-2 | C-4)

SCALE: 1" = 10'



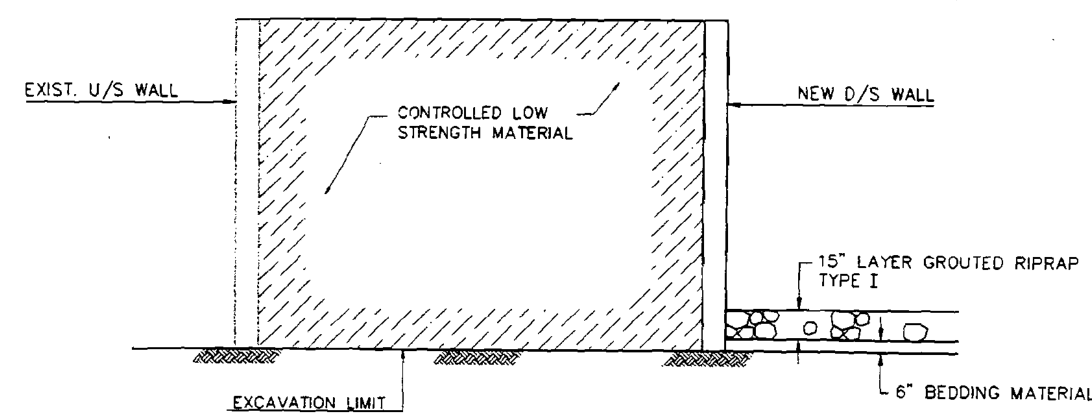
SECTION ⊙ STA. 10+50 (A, C-2 | C-4)

SCALE: 1" = 10'



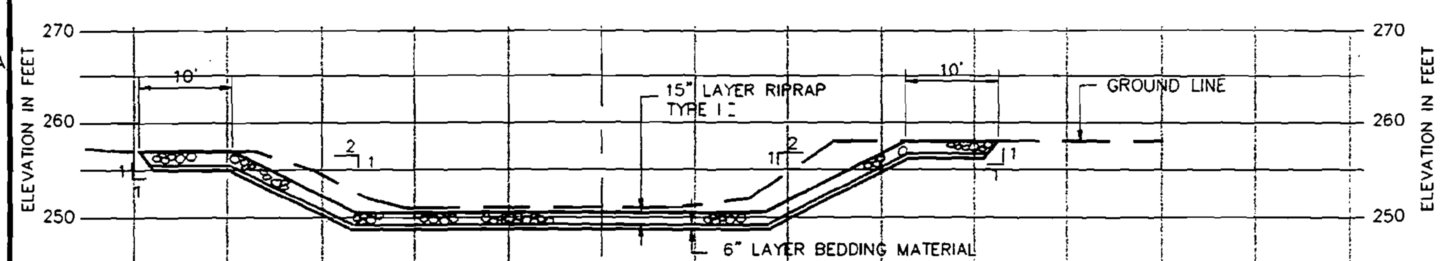
SECTION ⊙ STA. 11+90 (C, C-2 | C-4)

SCALE: 1" = 10'



SECTION (D, C-3 | C-4)

SCALE: 1/4" = 1'-0"

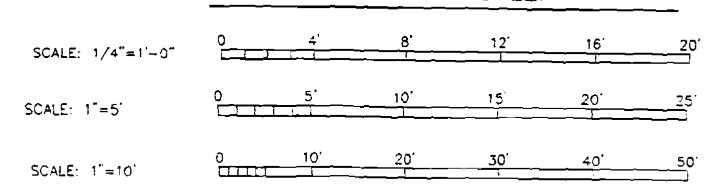


SECTION ⊙ STA. 11+20 (B, C-2 | C-4)

SCALE: 1" = 10'

AS-CONSTRUCTED

GRAPHIC SCALE:



of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	3/30/99	DCS

Designed by: K. Tate
Date: 15 JULY 1997
Rev
Dwn by: G. Bucknell
Ckd by: M. Ruthford
Design file no. ME-04-184
Reviewed by: R. Norris
SPEC No: 9743
Submitted by:
Chief, Struct. Des. Sec.
File name:
Plot date:
Plot scale: 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY CALIFORNIA
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
NEW TURNOUT STRUCTURE AND WEIR
PROFILE AND TYPICAL SECTIONS

Sheet reference number:
C-4
SHEET 6 OF 15

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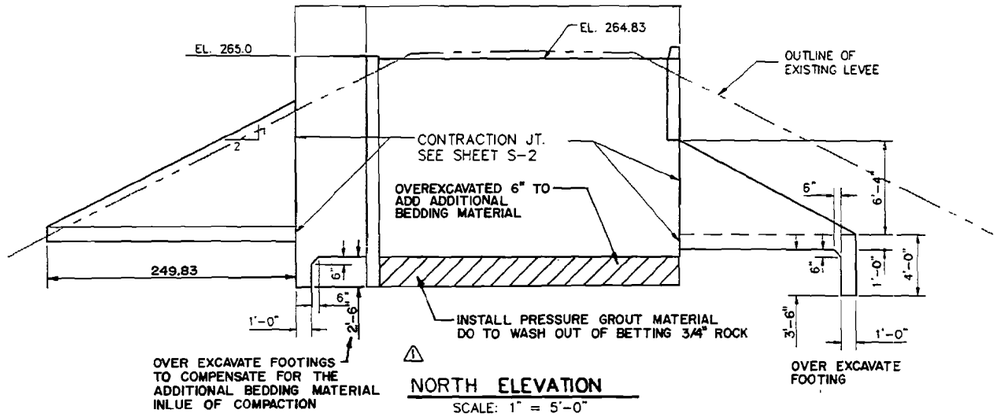
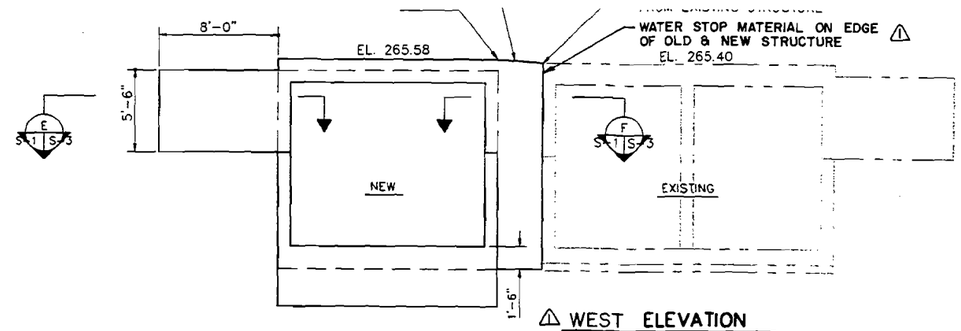
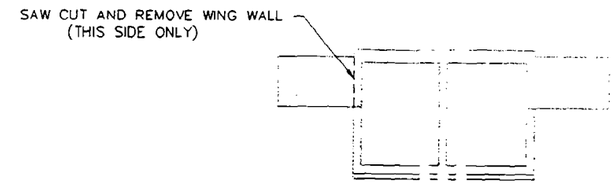


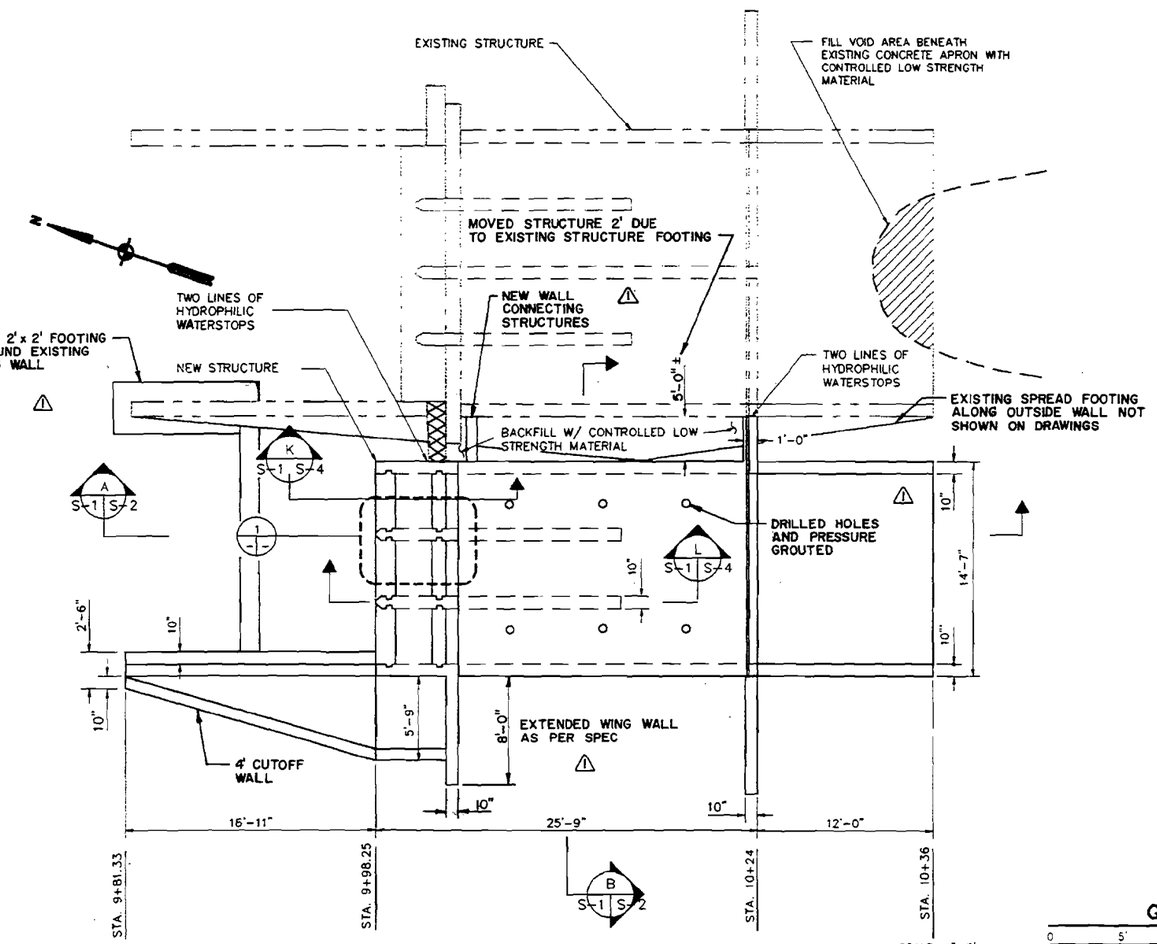
NORTH ELEVATION
SCALE: 1" = 5'-0"



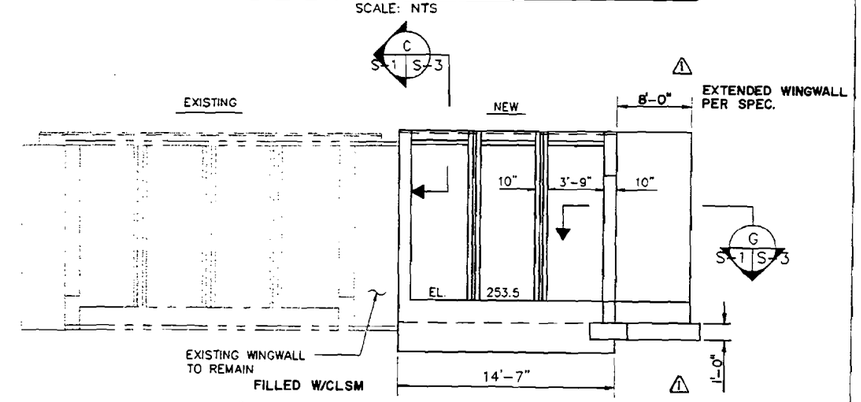
WEST ELEVATION
SCALE: 1" = 5'-0"



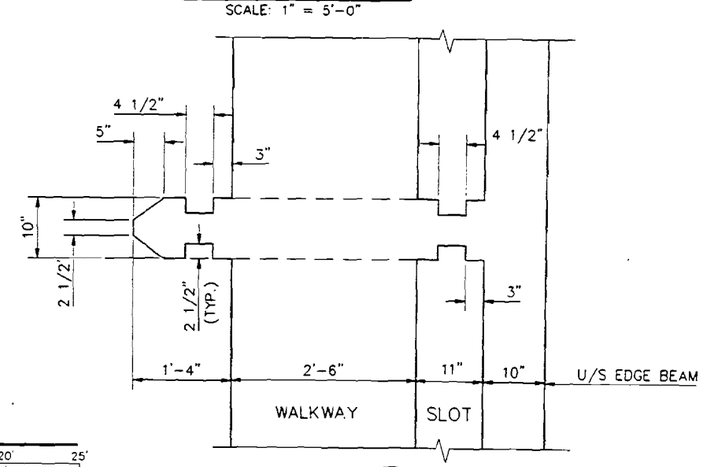
WEST ELEVATION - EXISTING STRUCTURE
SCALE: NTS



PLAN
SCALE: 1" = 5'-0"



EAST ELEVATION
SCALE: 1" = 5'-0"



DETAIL
SCALE: 1" = 1'-0"

GRAPHIC SCALES
SCALE: 1"=5'
SCALE: 1"=1'-0"

AS-CONSTRUCTED

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	10/09/2000	

Corps of Engineers
Sacramento District

Designed by: K. TATE
Dwn by: G. Buckwell
Ckd by: M. Rothford
Reviewed by: R. Norris
Submitted by:
Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Design file no: ME-04-164
SPEC. No: 8743
File name:
Plot date:
Plot scale: 1:1
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
CALIFORNIA

NEW TURNOUT STRUCTURE
PLAN AND ELEVATIONS

Sheet reference number:
S-1
SHEET 7 OF 15

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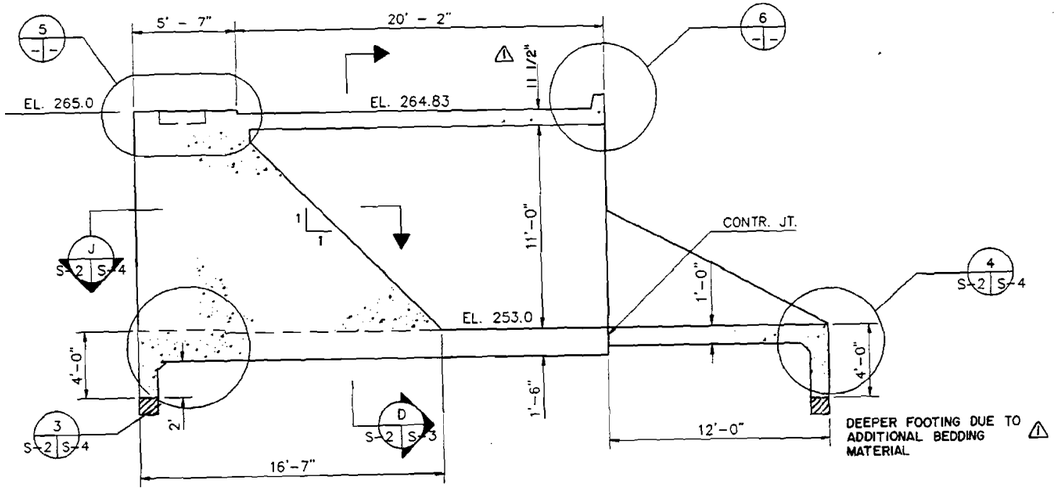
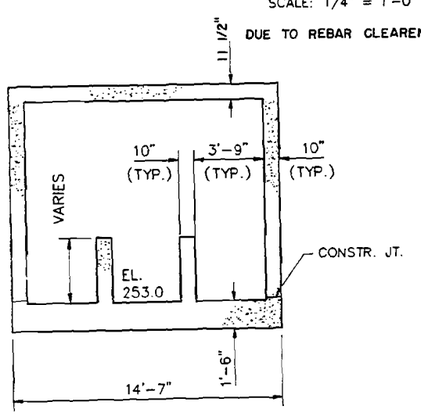
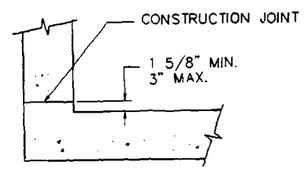


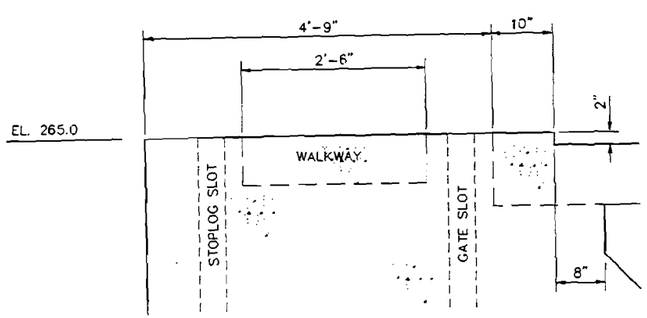
SECTION (A) S-1 S-2
SCALE: 1/4" = 1'-0"



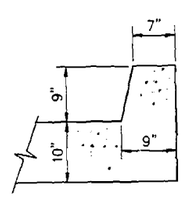
SECTION (B) S-1 S-2
SCALE: 1/4" = 1'-0"



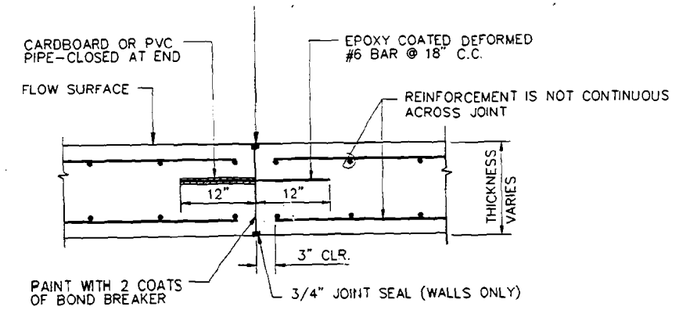
STARTER WALL DETAIL
SCALE: 1" = 1'-0"



DETAIL (5)
SCALE: 1" = 1'-0"



DETAIL (6)
SCALE: 1" = 1'-0"



NEW TURNOUT STRUCTURE
WALL AND SLAB CONTRACTION JOINT DETAIL
NTS

GENERAL STRUCTURAL NOTES:

CONCRETE AND REINFORCEMENT:

1. ALL EXPOSED CORNERS AND EDGES SHALL BE CHAMFERED 3/4", AND ALL REENTRANT CORNERS, EXCEPT WALL TO FLOOR CONSTRUCTION SHALL HAVE A 3/4" FILLET UNLESS OTHERWISE NOTED OR SHOWN.
2. ALL REINFORCEMENT SPLICES AND EMBEDMENT LENGTHS, UNLESS NOTED OTHERWISE, SHALL BE AS FOLLOWS:

fc'=4,000 psi. fy=60,000 psi.				
	LAP SPLICES, IN.		EMBEDMENT, IN.	
BAR SIZE	TOP BARS	OTHER BARS	TOP BARS	OTHER BARS
4	24	19	19	15
5	30	23	23	18
6	36	28	28	22
7	42	33	33	25

3. UNLESS NOTED OTHERWISE, ALL EMBEDMENTS BEYOND FACES OF OPENINGS OR SUPPORTS SHALL CONFORM TO THE TABLE SHOWN ABOVE.
4. UNLESS NOTED OTHERWISE, ALL HOOKS AND BENDS SHALL BE IN ACCORDANCE WITH ACI STANDARDS.
5. ALL SPLICES TO BE THE SPLICE LENGTH OF THE LARGER BAR SIZE BUT NOT LESS THAN 12" UNLESS SHOWN OTHERWISE.
6. UNLESS SHOWN OTHERWISE, STAGGER SPLICES IN ALTERNATE LONGITUDINAL REINFORCING AT LEAST 24 INCHES.
7. UNLESS OTHERWISE NOTED ALL NEW CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF AT LEAST 4,000 PSI AT 28 DAYS.
8. ALL NEW FORMED CONCRETE SURFACES SHALL HAVE A CLASS "B" OR "D" FINISH, SEE SPECS 03307.
9. REINFORCEMENT STEEL SHALL BE ASTM A615 WITH A YIELD STRENGTH OF 60,000 PSI.
10. ANCHOR BOLTS SHALL BE CAST IN PLACE OR ANCHORED IN PREDRILLED HOLES USING NEAT PORTLAND CEMENT GROUT AS SHOWN. DRILL HOLES SHALL BE BLOWN DRY IMMEDIATELY PRIOR TO INSERTION OF BOLT AND GROUT.

STRUCTURAL METALS NOTES:

1. ALL STRUCTURAL STEEL SHALL CONFORM TO ASTM SPECIFICATION A36, UNLESS NOTED OTHERWISE.
2. PIPE FOR RAILINGS SHALL COMPLY WITH ASTM A53 GRADE B.
3. ALL BURRS, SHARP EDGES AND PROTRUSIONS ON METAL ITEMS SHALL BE REMOVED.
4. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED UNLESS NOTED OTHERWISE

AS-CONSTRUCTED

GRAPHIC SCALES

SCALE: 1/4"=1'-0" 0 4' 8' 12' 16' 20'
SCALE: 1"=1'-0" 0 1' 2' 3' 4' 5'

of Engineers
Sacramento District

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	10/08/05					

Designed by K. Tate
Drawn by G. Buchner
Cad by M. Rutland
Reviewed by R. Norris
Submitted by
Chief, Struct. Des. Sec.
Date 15 JULY 1996
Design file no WE-04-164
SPEC No. 9743
File name:
Plot date:
Plot scale: 1:1
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY CALIFORNIA
MERCED COUNTY STREAMS GROUP
ENDENDALE CREEK

NEW TURNOUT STRUCTURE
SECTIONS AND DETAILS
GENERAL STRUCTURAL NOTES

Sheet reference number:
S-2
SHEET 8 OF 13

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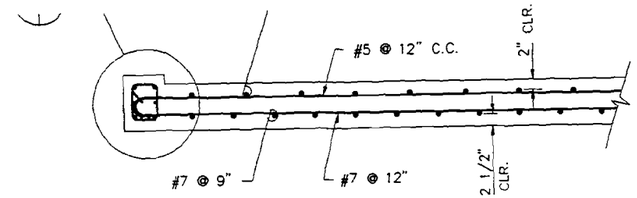
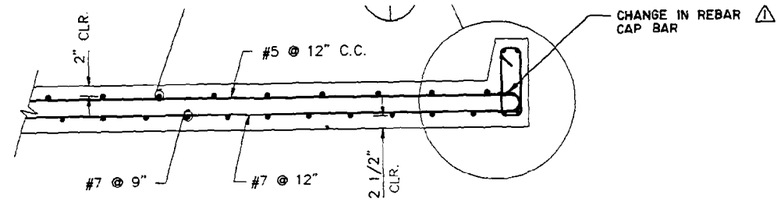
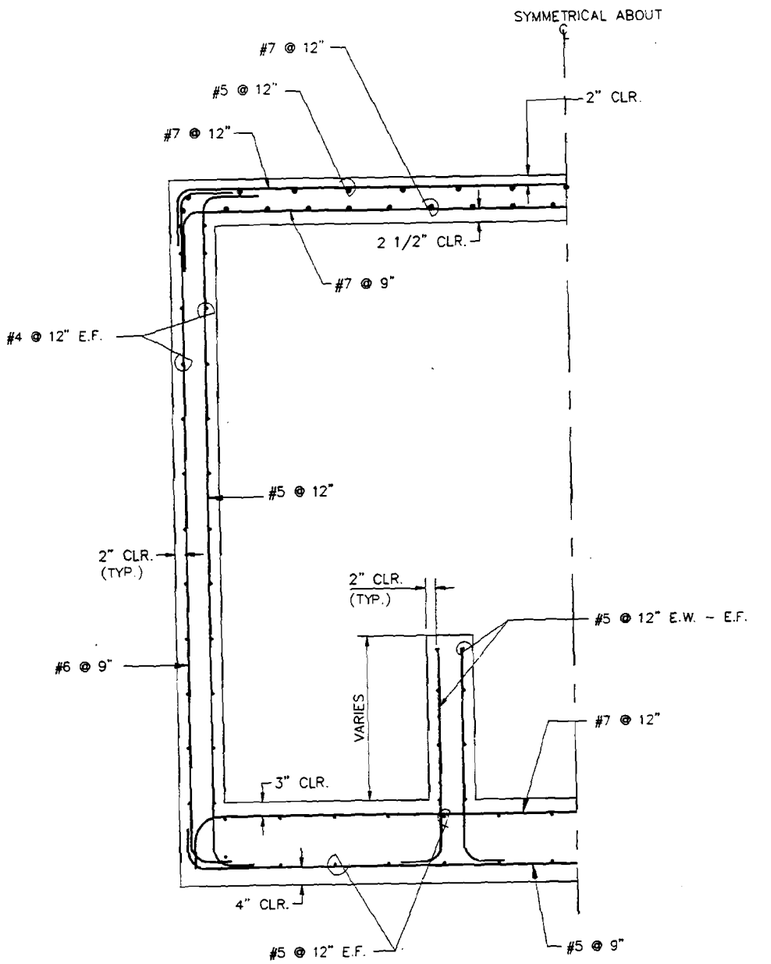
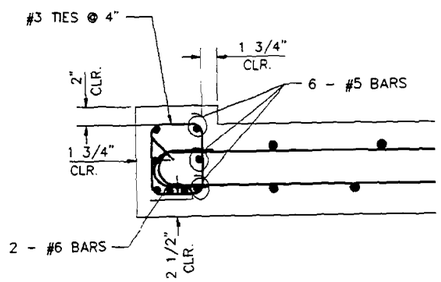


SECTION C
SCALE: 3/4" = 1'-0" S-1 | S-3

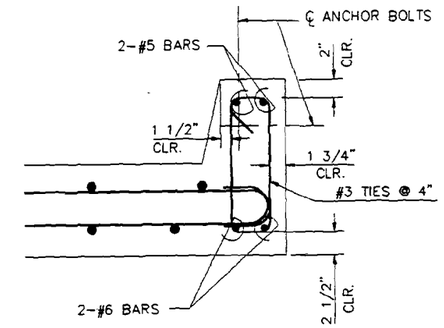




SECTION D
SCALE: 3/4" = 1'-0" S-2 | S-3



DETAIL 1
SCALE: 1 1/2" = 1'-0"



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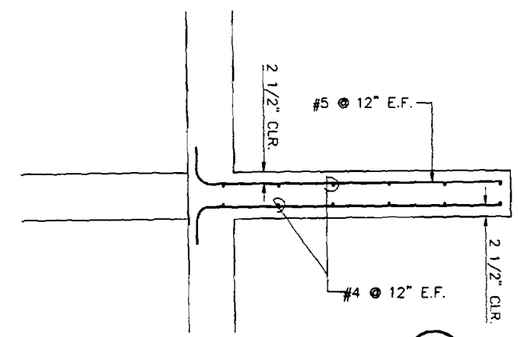
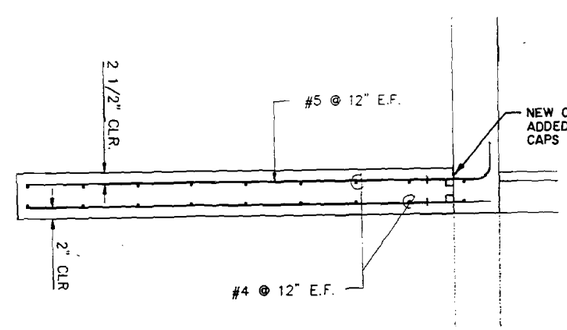
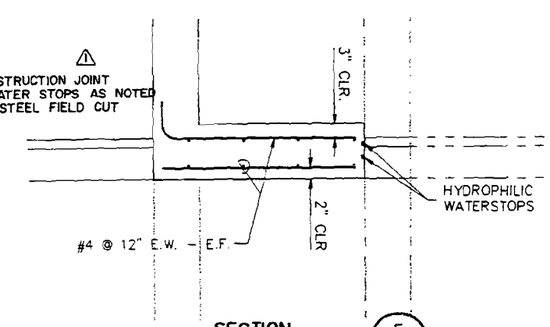
SCALE: 1 1/2" = 1'-0"



SECTION G
SCALE: 3/4" = 1'-0" S-1 | S-3



SECTION E
SCALE: 3/4" = 1'-0" S-1 | S-3



SECTION F
SCALE: 3/4" = 1'-0" S-1 | S-3

GRAPHIC SCALES

SCALE: 3/4"=1'-0" 0 1' 2' 3' 4' 5' 6' 7'

SCALE: 1-1/2"=1'-0" 0 1' 2' 3'

AS-CONSTRUCTED

of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	4/7/99	DCS

Date: 15 JULY 1997
Rev.
Design file no: WE-04-164
SPEC. No.:
Designed by: K. Tate
Dwn by: G. Bozwell
Ckd by: M. Rutherford
Reviewed by: R. Hardie
Submitted by: Chief, Struct. Des. Sec.
File name:
Plot date:
Plot scale: 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

NEW TURNOUT STRUCTURE
REINFORCING SECTIONS

Sheet reference number:
S-3
Sheet 9 OF 15

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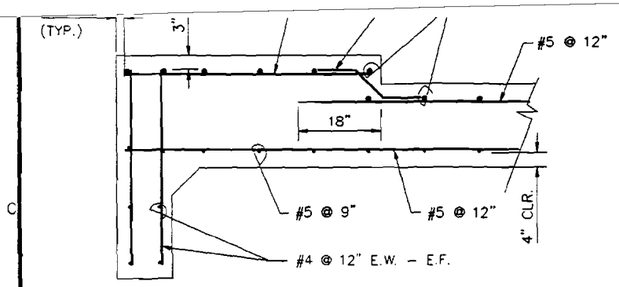
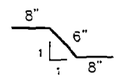
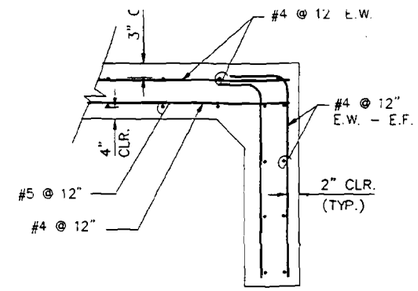


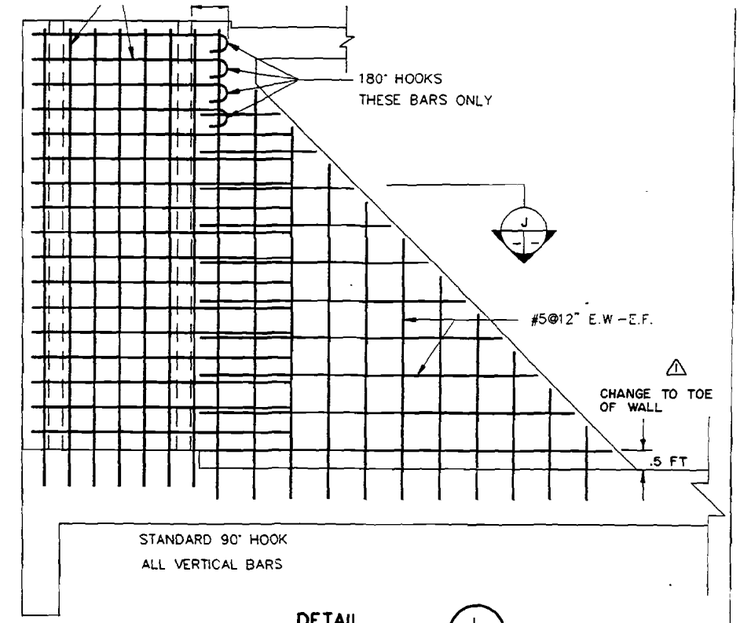
DETAIL 3
SCALE: 3/4" = 1'-0"
S-2 | S-4



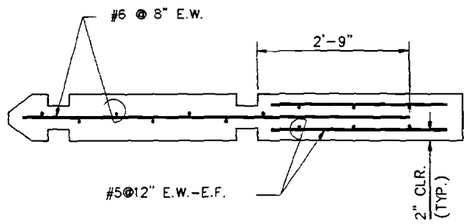
"a" BAR
(#4 @ 12")



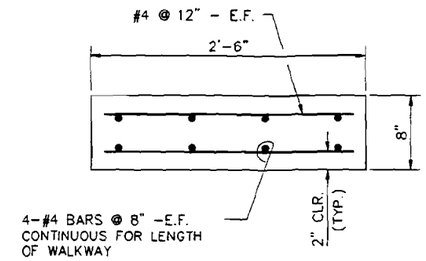
DETAIL 4
SCALE: 3/4" = 1'-0"
S-2 | S-4



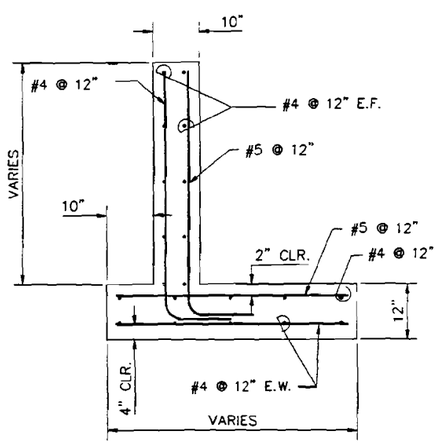
DETAIL L
SCALE: 1/2" = 1'-0"
S-1 | S-4



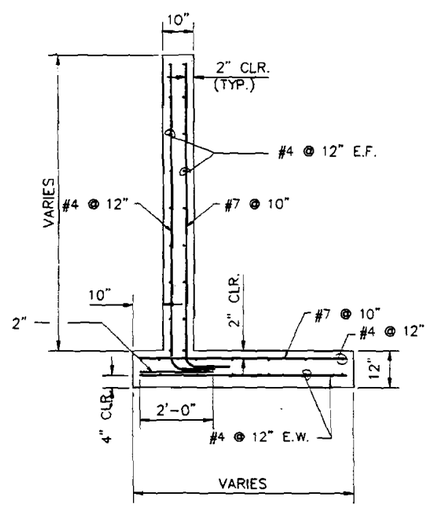
SECTION J
SCALE: 3/4" = 1'-0"
– | –



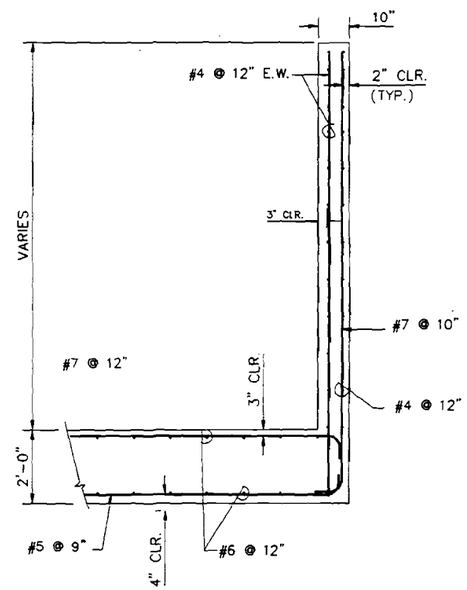
SECTION K
SCALE: 3/4" = 1'-0"
S-1 | S-4



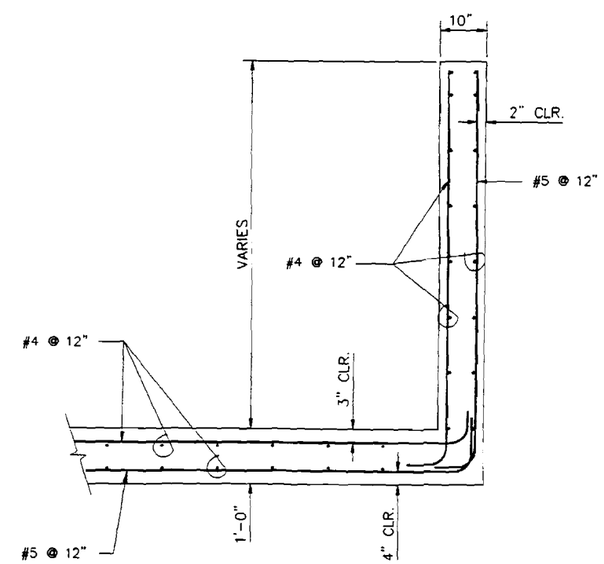
SECTION – STA. 9+81.33 TO 9+90
SCALE: 3/4" = 1'-0"



SECTION – STA. 9+91 TO 9+98.25
SCALE: 1/2" = 1'-0"



SECTION – STA. 9+98.25 TO 10+03
SCALE: 1/2" = 1'-0"



SECTION – STA. 10+24 TO 10+36
SCALE: 3/4" = 1'-0"

AS-CONSTRUCTED

GRAPHIC SCALES

SCALE: 1/2"=1'-0" 0 1' 2' 3' 4' 6' 8' 10'

SCALE: 3/4"=1'-0" 0 1' 2' 3' 4' 5' 6' 7'

of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	4/2/98	DCS

Designed by: K. Tate
Dwn by: G. Burtnett
Ckd by: Jr. Rainford
Reviewed by: R. Norris
Submitted by: Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Design file no: MC-D4-184
SPEC No: 8743
File name:
Plot date:
Plot scale: 1:1
Title:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
CALIFORNIA

NEW TURNOUT STRUCTURE
REINFORCING SECTIONS

Sheet reference number:
S-4
Sheet 10 OF 15

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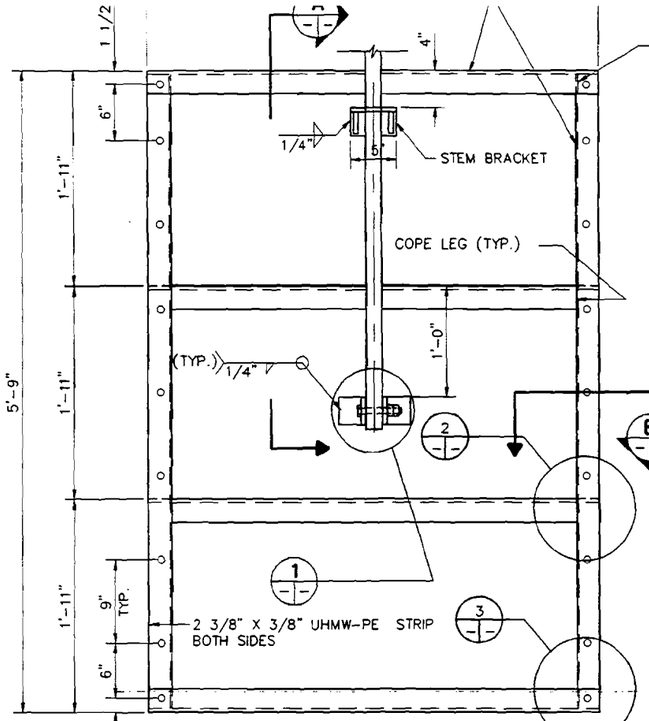
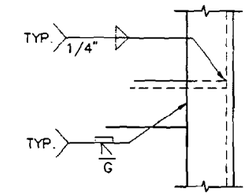


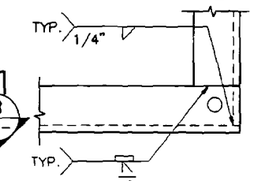
SLIDE GATE ELEVATION (D/S SIDE)

SCALE: 1 1/2" = 1'-0"



DETAIL 2

SCALE: 3" = 1'-0"

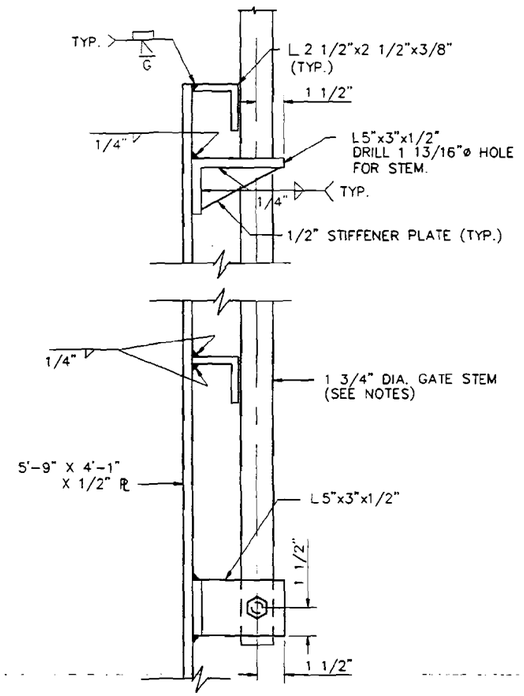


DETAIL 3

SCALE: 3" = 1'-0"

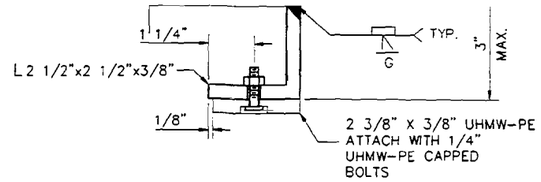
NOTES:

1. METALLIZE GATES AFTER FABRICATION. SEE SPECIFICATION 05036.
2. INSTALL STAINLESS STEEL STOP NUT ON STEM ABOVE OPERATOR. LOCATE NUT WITH GATE IN FULLY CLOSED POSITION. LOCK IN PLACE WITH 1/4" SET SCREW.
3. GATE STEM TO BE 1 3/4" DIA. STAINLESS STEEL 14'-0" TOTAL LENGTH, 10'-6" THREADED LENGTH



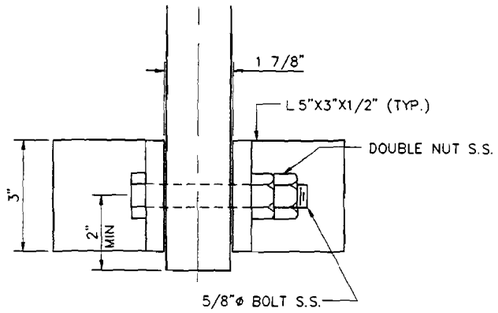
SECTION A

SCALE: 3" = 1'-0"



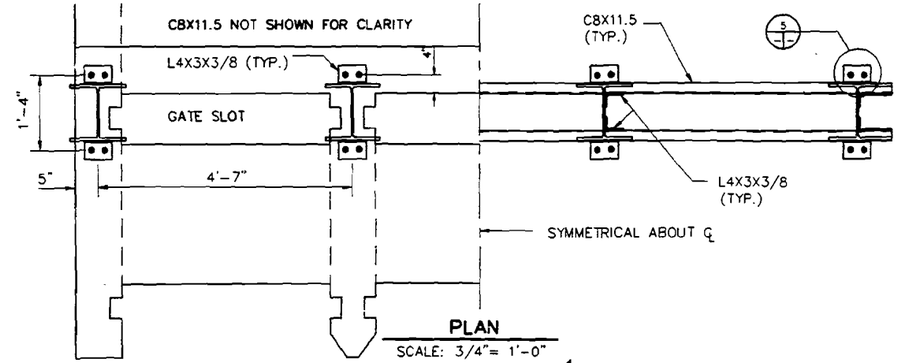
SECTION B

SCALE: 6" = 1'-0"



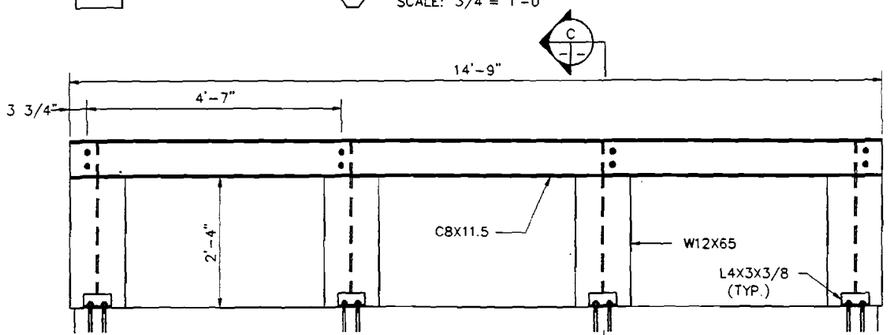
DETAIL 1

SCALE: 6" = 1'-0"



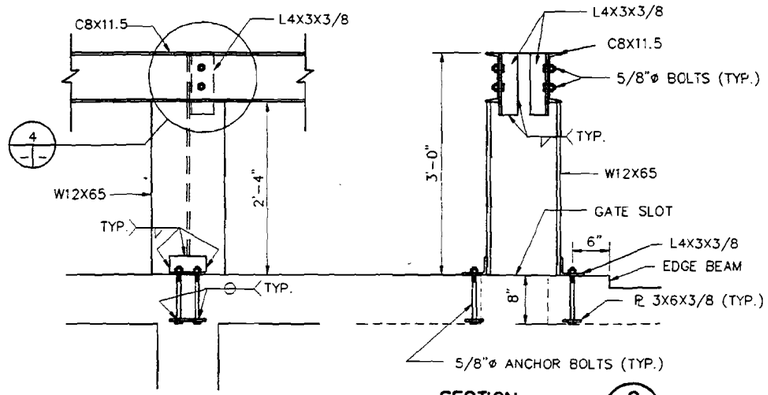
PLAN

SCALE: 3/4"= 1'-0"



ELEVATION

SCALE: 3/4"= 1'-0"



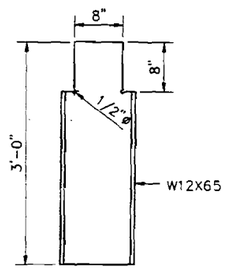
FRONT VIEW

SECTION C

SCALE: 1" = 1'-0"

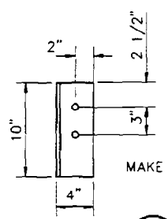
GATE OPERATOR SUPPORT

SCALE: 1"= 1'-0"



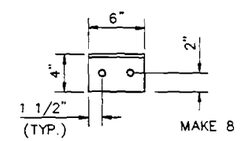
W12X65

AS-CONSTRUCTED



DETAIL 4

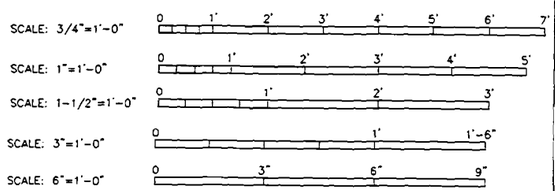
SCALE: 1 1/2" = 1'-0"



DETAIL 5

SCALE: 1 1/2" = 1'-0"

GRAPHIC SCALES:



U. S. Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved

Designed by: K. Tate
Dwn by: G. Buckner
Ckd by: M. Rutford
Reviewed by: R. Harris
Submitted by: Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Design file no: MC-DN-184
SPEC. No.: 8743
File name:
Plot date:
Plot scale: 1:1
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY CALIFORNIA
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

NEW TURNOUT STRUCTURE
SLIDE GATE AND
GATE OPERATOR DETAILS

Sheet reference number:
S-5
SHEET 11 OF 15

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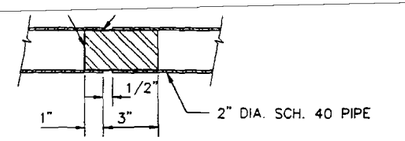
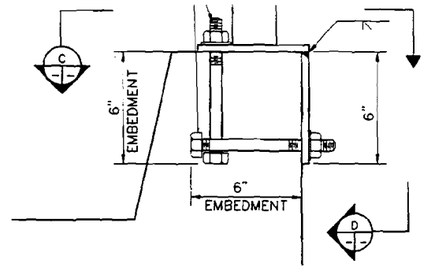
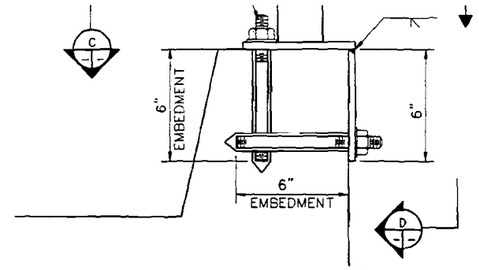


NOTE: SLIP JOINTS IN HANDRAIL SHALL BE PLACED NEAR JOINTS IN WALL STEM OF CONC. WALLS OR WHERE SPECIFIED ON DRAWINGS.

DETAIL 4
SCALE: 1 1/2" = 1'-0"



DETAIL 5
SCALE: 3" = 1'-0"



DETAIL 6
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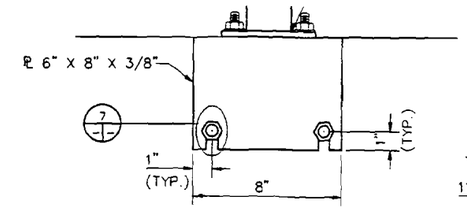
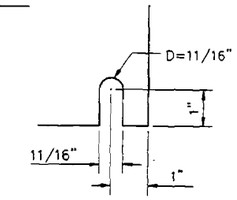
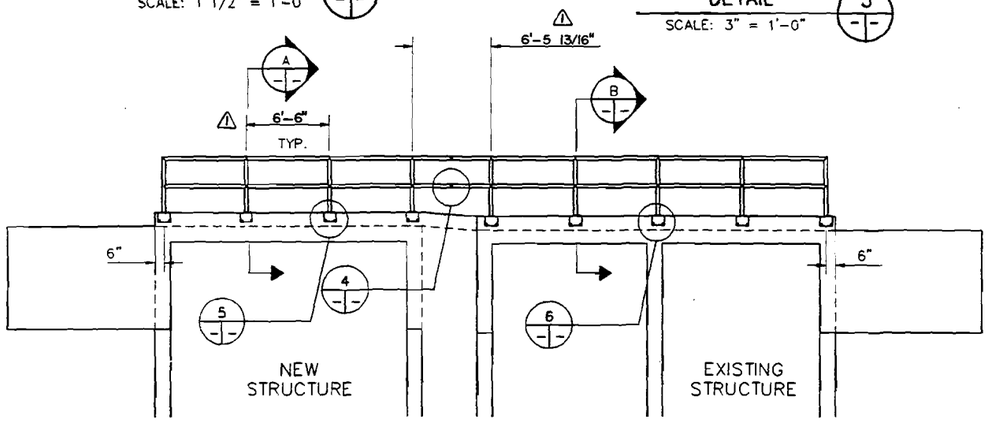


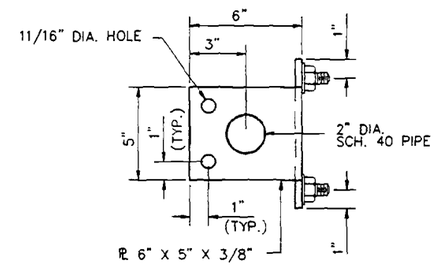
SECTION D
SCALE: 3" = 1'-0"



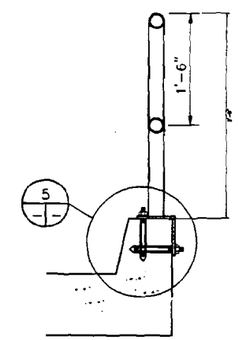
DETAIL 7
NTS



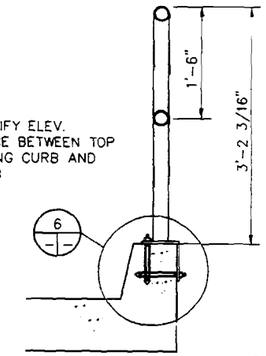
HANDRAILING - SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



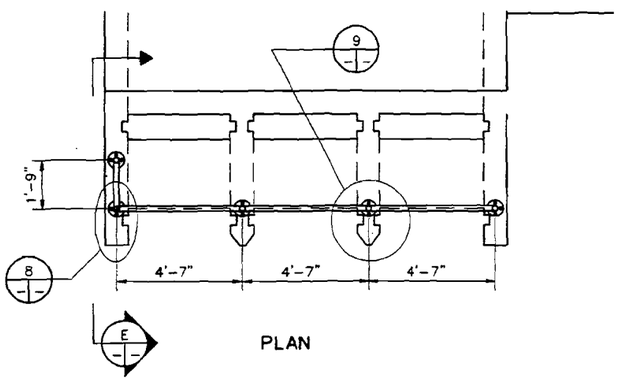
SECTION C
SCALE: 3" = 1'-0"



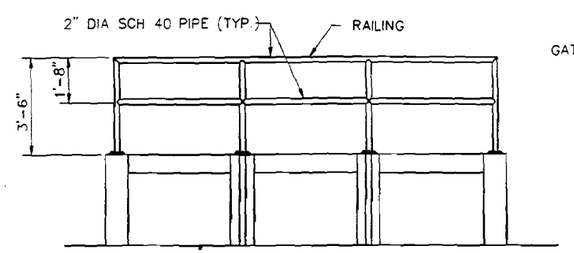
SECTION A
SCALE: 1" = 1'-0"



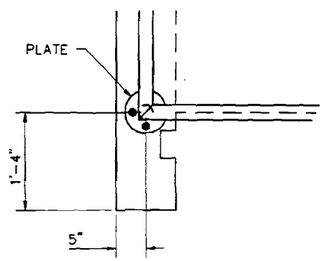
SECTION B
SCALE: 1" = 1'-0"



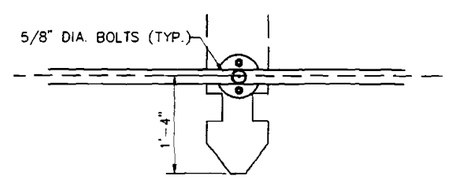
PLAN



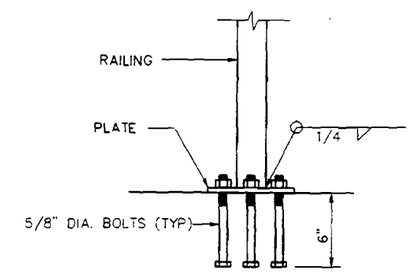
HANDRAILING - NORTH ELEVATION
SCALE: 3/8" = 1'-0"



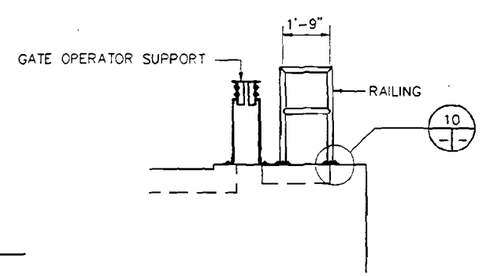
DETAIL 8
SCALE: 1" = 1'-0"



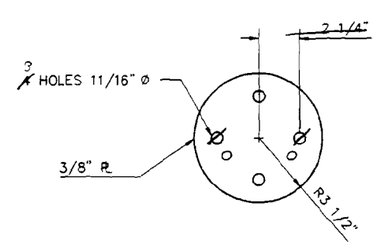
DETAIL 9
SCALE: 1" = 1'-0"



DETAIL 10
SCALE: 1" = 6"



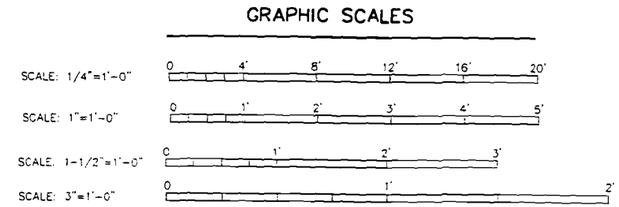
SECTION E
SCALE: 3/8" = 1'-0"



BASE PLATE
SCALE 1" = 4"

AS-CONSTRUCTED

GRAPHIC SCALES



of Engineers
Sacramento District

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	6/2/98	DCS	D/S			

Designed by: K. Tate
Dwn by: G. Buckwell
Ckd by: M. Rutherford
Reviewed by: R. Morris
Submitted by:
Chief, Struct. Des. Sec.
Date: 15 JULY 1997
Rev.
Design file no: MC-04-164
SPEC. No: 8743
File name:
Plot date:
Plot scale: 1:1

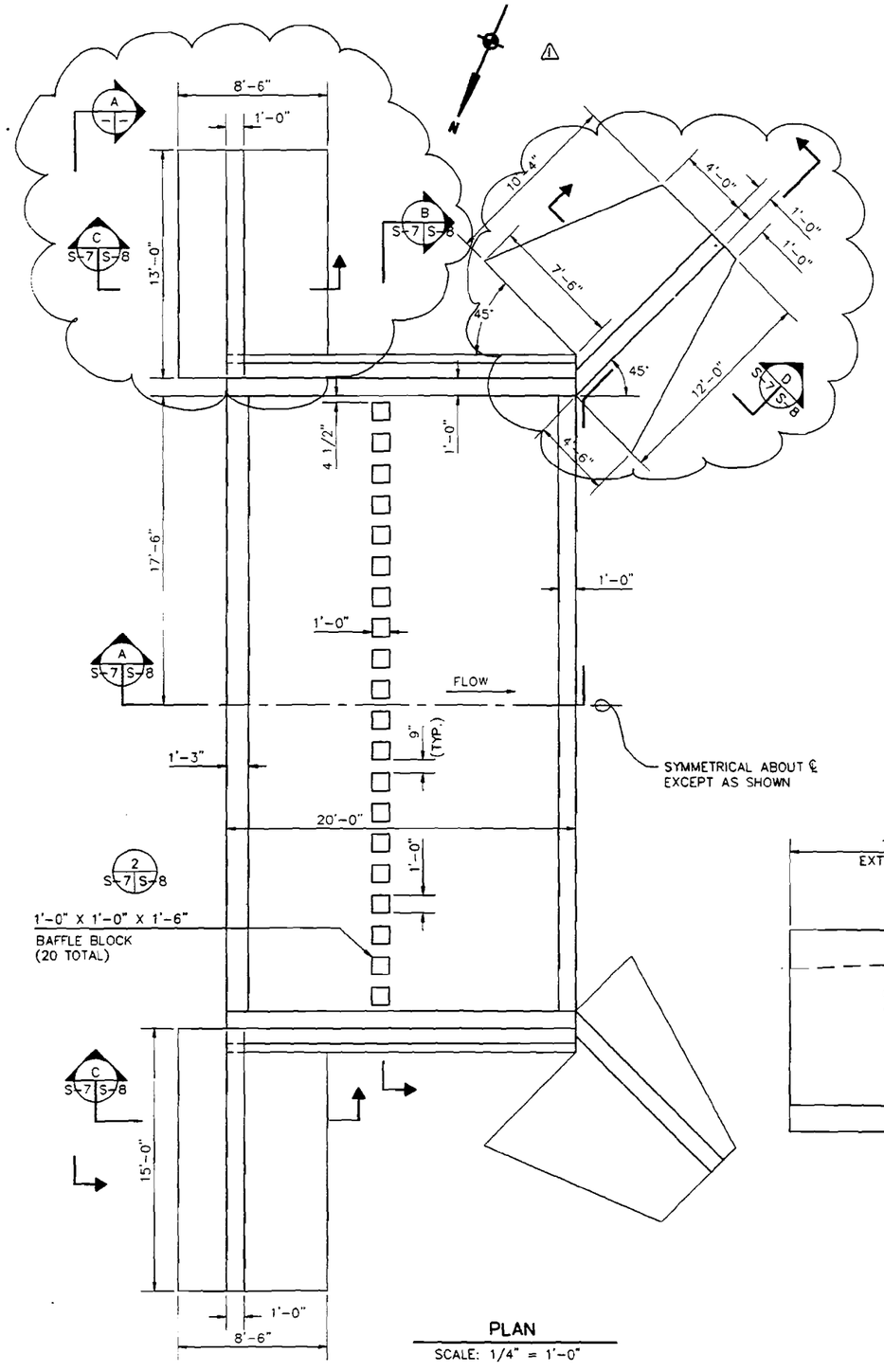
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

CALIFORNIA
MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

NEW TURNOUT STRUCTURE
HANDRAILING DETAILS

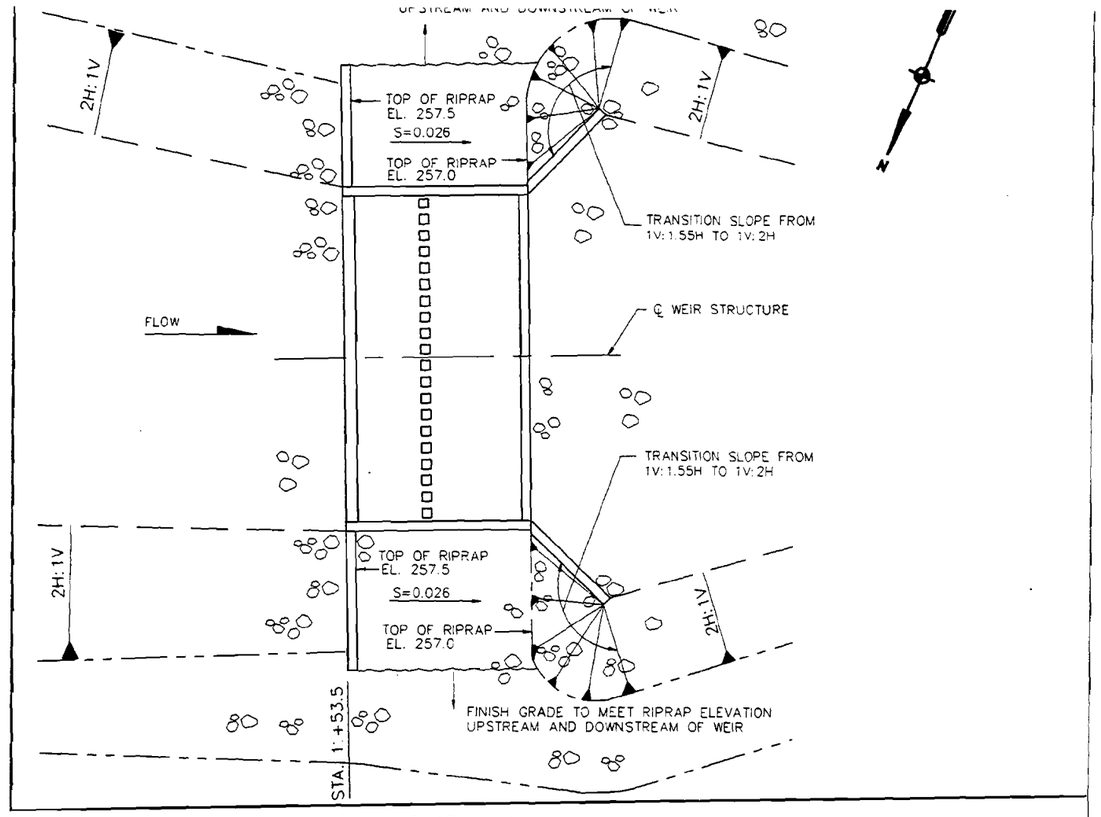
Sheet reference number:
S-6
SHEET 12 OF 15

C:\PROJECTS\EDENDALE\EDEN-S6 06/09/97 10:23



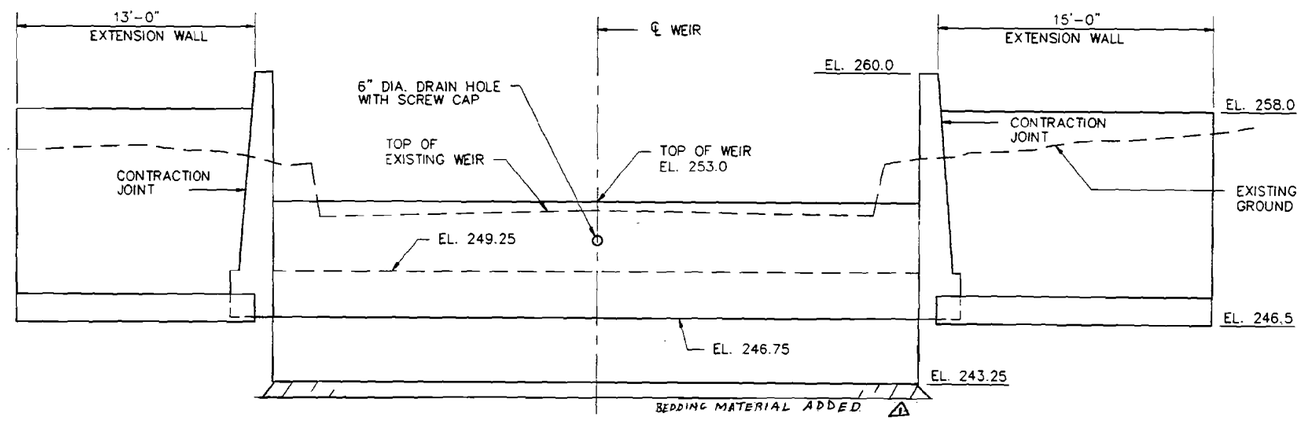
PLAN

SCALE: 1/4" = 1'-0"



GRADING PLAN

SCALE: 1/8" = 1'-0"



SECTION

SCALE: 1/4" = 1'-0"

AS-CONSTRUCTED

GRAPHIC SCALE:

SCALE: 1/8"=1'-0" 0 4' 8' 16' 24' 32' 40'

SCALE: 1/4"=1'-0" 0 4' 8' 12' 16' 20'

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	4/2/98	DCS

Designed by: C. Wang
Dwn by: G. Buckwell
Ckd by: M. Rutland
Reviewed by: R. Norris
Submitted by: Chief, Struct. Des. Sec.
Date: 15 JULY 1987
Rev
Design file no: MC-04-184
SPEC. No.: 8743
File name:
Plot date:
Plot scale: 1:1

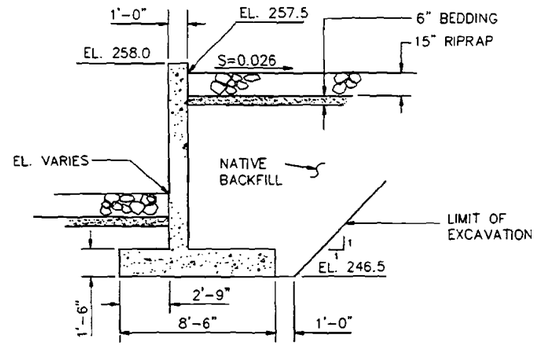
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
CALIFORNIA

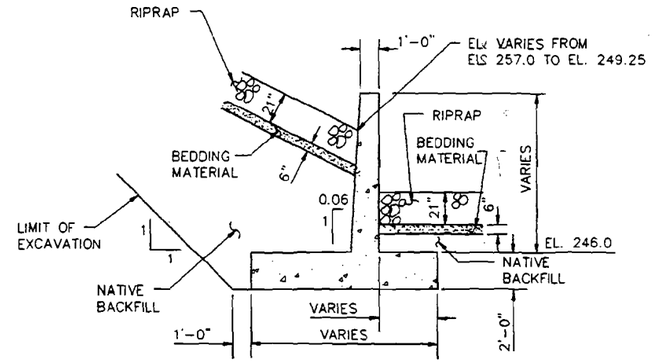
WEIR STRUCTURE
PLAN AND SECTION

Sheet reference number:
S-7
Sheet 13 of 15

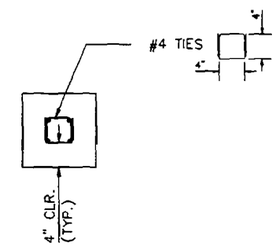
C:\PROJECTS\EDENDALE\EDEN-S7 04/07/87 08:26



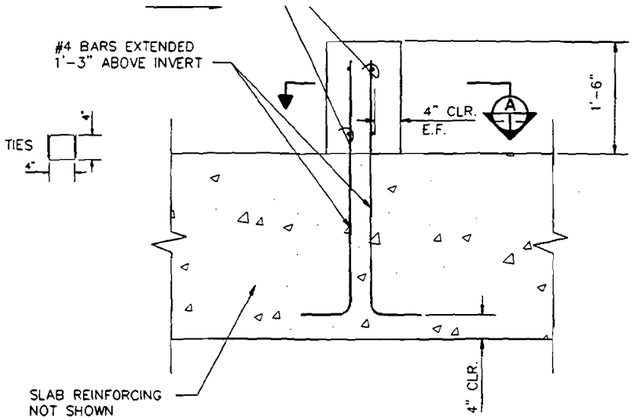
SECTION C
SCALE: 1/4" = 1'-0"
S-7 | S-8



SECTION D
SCALE: 1/4" = 1'-0"
S-7 | S-8

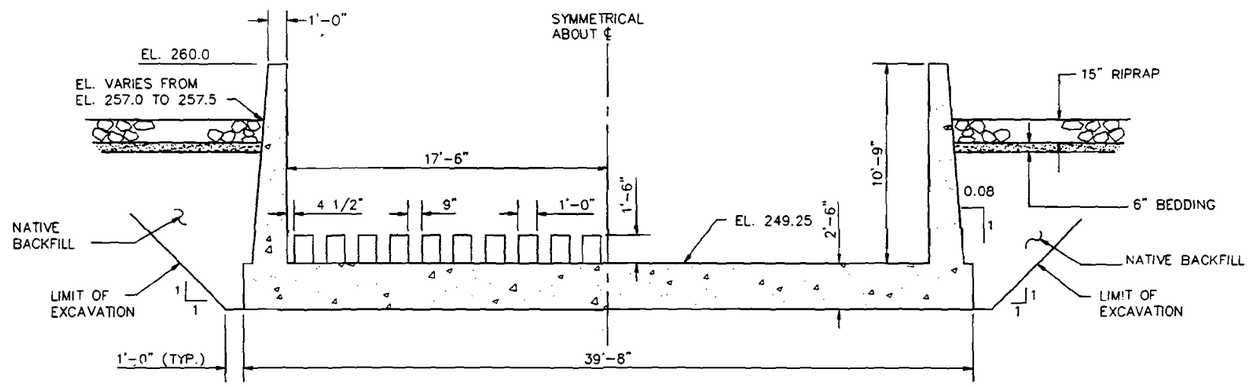


SECTION A
SCALE: 1" = 1'-0"

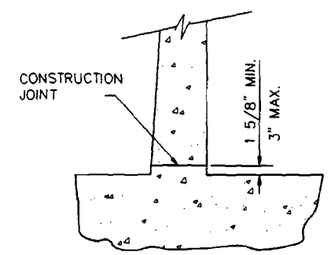


DETAIL 1
SCALE: 1" = 1'-0"
S-9 | S-8

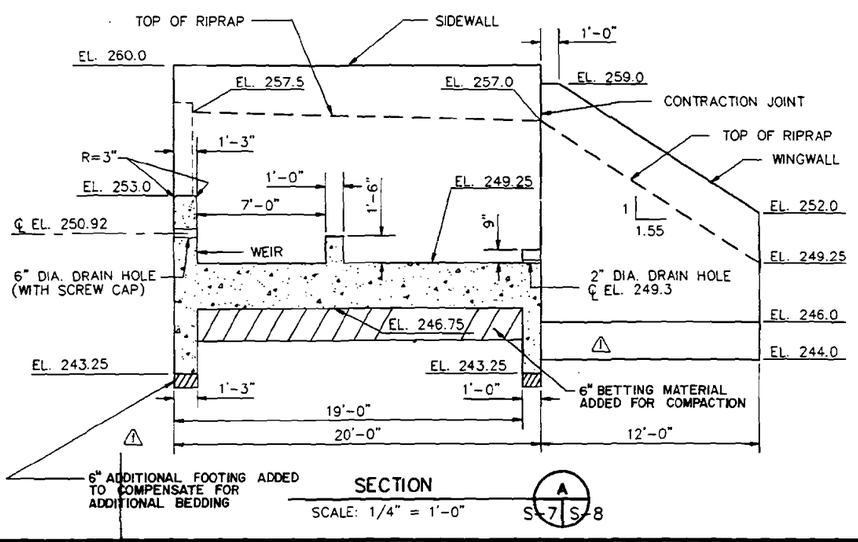
BAFFLE BLOCK REINFORCING
SCALE: 1" = 1'-0"



SECTION B
SCALE: 1/4" = 1'-0"
S-7 | S-8



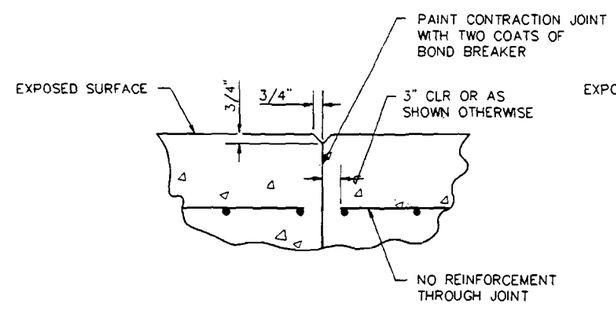
STARTER WALL DETAIL
NOT TO SCALE



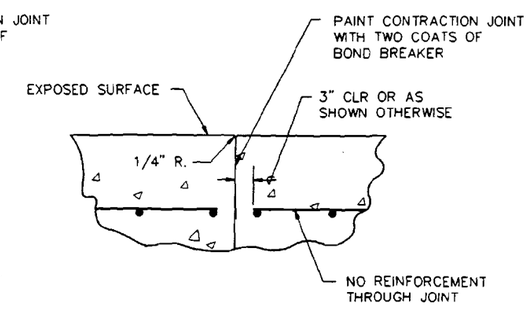
SECTION A
SCALE: 1/4" = 1'-0"
S-7 | S-8

NOTES:

1. THE DRAIN HOLES SHOWN IN SECTION "A" ARE LOCATED AT CENTERLINE OF WEIR STRUCTURE.
2. ALL CONCRETE FOR THE WEIR STRUCTURE SHALL HAVE 4000 PSI COMPRESSIVE STRENGTH IN 28 DAYS.
3. SEE SHEET S-2 FOR GENERAL STRUCTURAL NOTES.



WALL CONTRACTION JOINT – VERTICAL



SLAB CONTRACTION JOINT

CONTRACTION JOINT DETAIL FOR WEIR
NOT TO SCALE

AS-CONSTRUCTED

GRAPHIC SCALES:

SCALE: 1/4"=1'-0" 0 4' 8' 12' 16' 20'

SCALE: 1"=1'-0" 0 1' 2' 3' 4' 5'

of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	REVISED AS-CONSTRUCTED	10/6/06	

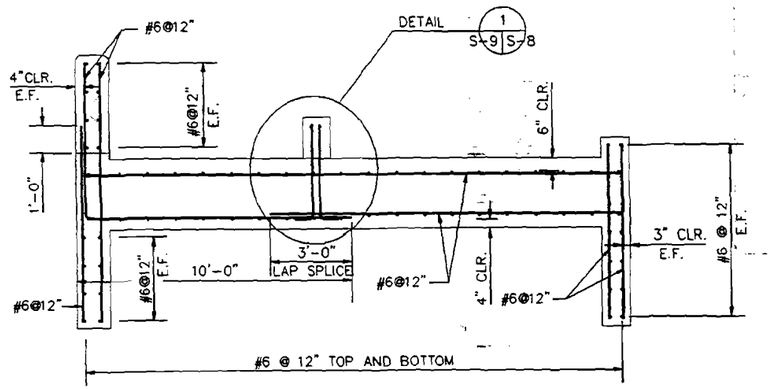
Designed by: C. WONG	Date: 15 JULY 1997	Rev.
Dwn by: E. Edwards	Ckd by: J. Rushford	Design file no: MC-DA-19-W
Reviewed by: R. Norris		SPEC. No: 9743
Submitted by:		File name:
Chief, Struct. Des. Sec.		Plot date: Plot scale: 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

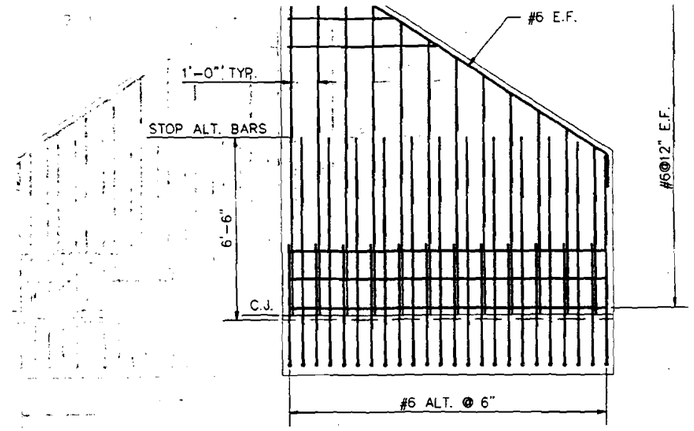
9743 MERCED COUNTY STREAMS GROUP
EDENDALE CREEK
CALIFORNIA

WEIR STRUCTURE
SECTIONS AND DETAILS

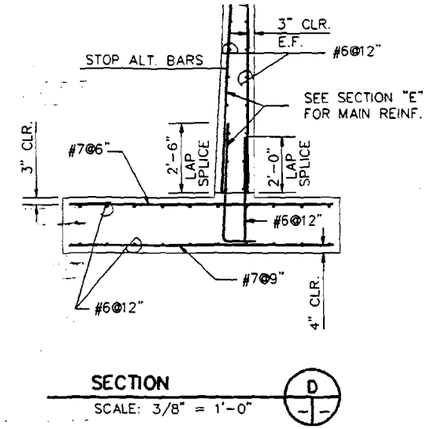
Sheet reference number:
S-8
Sheet 14 of 15



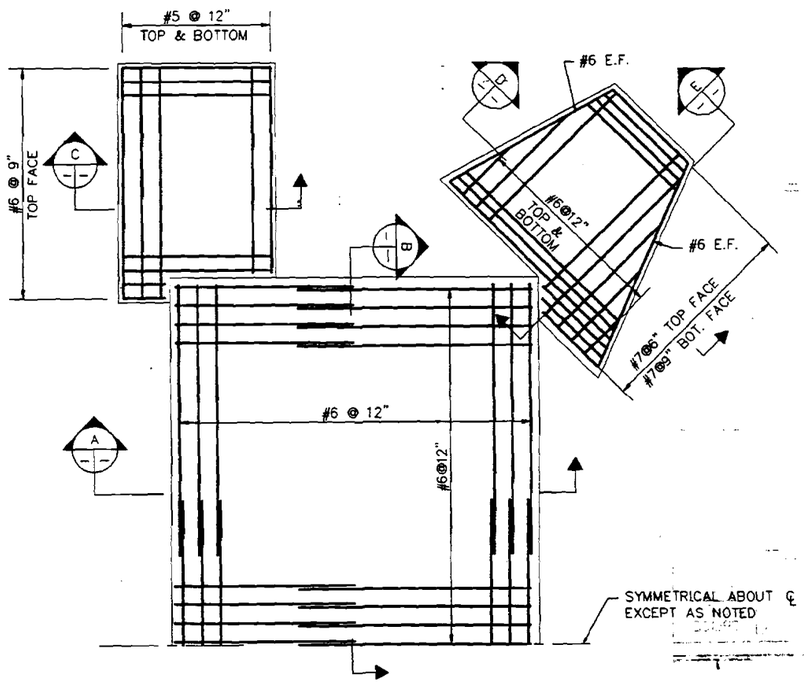
SECTION A
SCALE: 3/8" = 1'-0"



SECTION E
SCALE: 3/8" = 1'-0"



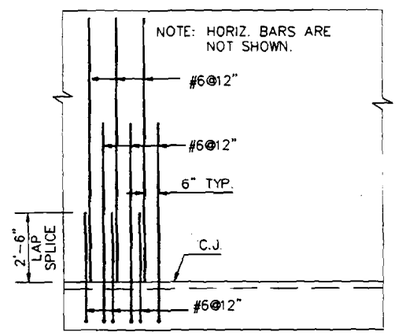
SECTION D
SCALE: 3/8" = 1'-0"



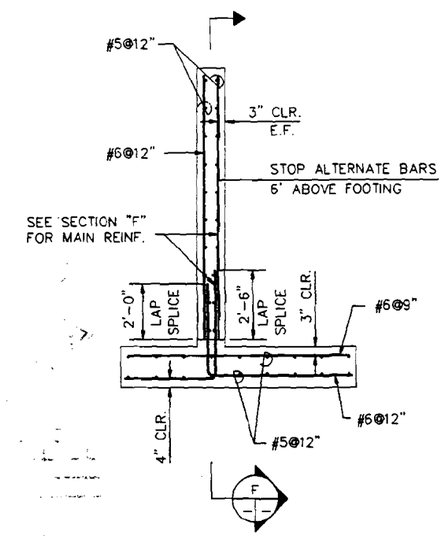
NOTES:

1. REINFORCEMENT IS SHOWN FOR DESIGNATED FACE OF SLAB ONLY. SEE SECTIONS FOR REINFORCEMENT AT OTHER FACE NOT SPECIFIED.
2. SEE SECTIONS A AND B FOR LOCATIONS OF SPLICES.

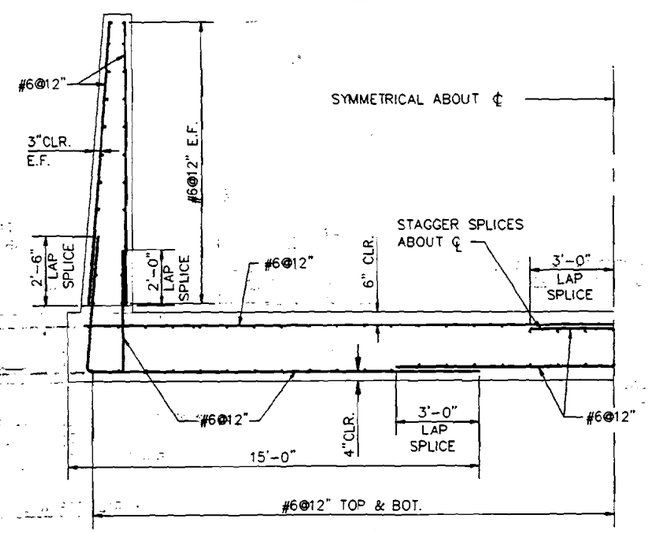
PLAN - SLAB REINFORCEMENT
SCALE: 1/4" = 1'-0"



SECTION F
SCALE: 3/8" = 1'-0"



SECTION C
SCALE: 3/8" = 1'-0"



SECTION B
SCALE: 3/8" = 1'-0"

AS-CONSTRUCTED

NOTES:

1. SEE SHEET S-2 FOR GENERAL STRUCTURAL NOTES.
2. UNLESS OTHERWISE SHOWN, ALL STEEL REINFORCEMENT SHALL HAVE A MINIMUM CONCRETE COVER OF 3".

GRAPHIC SCALES

SCALE: 1/4"=1'-0" 0 4' 8' 12' 16' 20'
SCALE: 3/8"=1'-0" 0 1' 2' 3' 4' 5' 6' 7' 8' 10' 12' 14'

of Engineers
Sacramento District

Symbol	Description	Date	Approved	Symbol	Description	Date	Approved

Designed by C. Wong | Date 15 JULY 1997 | Rev.
Dwn by G. Buckwell | Ckd by M. Rohlfard | Design file no. MC-04-164
Reviewed by R. Norris | SPEC No. 9743
Submitted by Chief, Struct. Des. Sec. | File name | Plot date | Plot scale 1:1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

MERCED COUNTY CALIFORNIA
MERCED COUNTY STREAMS GROUP
EDENDALE CREEK

WEIR STRUCTURE
REINFORCING DETAILS

Sheet reference number:
S-9
Sheet 15 of 15

C:\PROJECTS\EDENDALE\EDEN-S9 06/11/97 09:13