

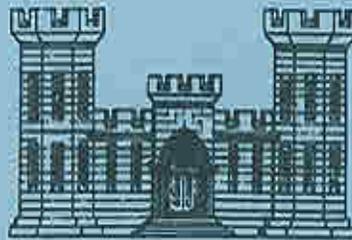
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EEL RIVER (AT SANDY PRAIRIE)

FLOOD CONTROL PROJECT

HUMBOLDT COUNTY, CALIFORNIA

OPERATION AND MAINTENANCE MANUAL



U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

April 1961

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EEL RIVER (AT SANDY PRAIRIE)
FLOOD CONTROL PROJECT

HUMBOLDT COUNTY, CALIFORNIA

April 1961

INTRODUCTION

1. AUTHORIZATION

The project for flood control on the Eel River at Sandy Prairie was authorized by the Flood Control Act of 1958, Public Law 85-500, 85th Congress, 2d Session, approved 3 July 1958, which Act reads in part as follows:

"The following works of improvement for the benefit of navigation and the control of destructive flood waters and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and the supervision of the Chief of Engineers in accordance with plans in the respective reports hereinafter designated and subject to the conditions set forth therein:

EEL RIVER BASIN

"The project for flood protection on the Eel River, in the Sandy Prairie region, California, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Number 80, 85th Congress, at an estimated cost of \$707,000."

2. LOCATION

The Eel River at Sandy Prairie Flood Control project is located along the lower reaches of the Eel River near the city of Fortuna, California (population 3,524), some ten miles above the mouth of the river. The river drains 3,630 square miles in the northwestern part of California including portions of Humboldt, Mendocino, Trinity, Glenn and Lake Counties. The river flows northwesterly to join the Pacific Ocean, 15 miles south of the city of Eureka. The city of Eureka is northwestern California's principal city (population 27,813), and is located some 285 miles north of San Francisco. Both Eureka and Fortuna are served by Highway U. S. 101, State Highway 1, and an interconnecting system of county roads. Regular bus service is available and the Northwestern Pacific Railroad provides regular freight service between Eureka and San Francisco.

3. DESCRIPTION OF PROJECT

The project consists of a 21,189-foot long earthfill levee located south of the city of Fortuna, California, along the left bank of Strongs Creek and the right banks of the Eel River and the Van Duzen River. The levee is protected by riprap for a distance of 8,132 feet where it is exposed to erosive action from the Eel River. Included in the project is the necessary realignment and clearing of the channel along the levee reaches.

4. PROTECTION PROVIDED

The project as constructed will provide protection for the city of Fortuna from the floodwaters of Eel River. It will prevent flooding of business, industrial and residential areas situated within the flood plain from floods up to the magnitude of the standard project flood. The peak flow adopted for the Standard Project Flood is 630,000 c.f.s.

5. CONSTRUCTION HISTORY

Construction of the project was initiated in November of 1958 when work was started on the riprapped portion of the levee. This portion of the project was completed in April 1959. The construction of the earthfilled levee began in July 1959, and was completed in November 1959.

LOCAL COOPERATION REQUIREMENTS

6. ASSURANCE OF COOPERATION

By Resolution No. 1182, dated 30 September 1958, the Board of Supervisors of Humboldt County stated that:

WHEREAS the San Francisco District Engineer, Corps of Engineers, U. S. Army, is undertaking a plan of improvement for flood control on the Eel River at Sandy Prairie area, Fortuna, California; and WHEREAS the Congress of the United States has enacted a bill which would provide funds for such flood control project, and said bill has been signed into law by the President of the United States; and

WHEREAS a request has been made of this Board of Supervisors that it enact a resolution showing the ability of local interests to meet their commitments of local cooperation, as specified in Project Document (HD 80-85-1), in the form of assurances satisfactory to the Secretary of the Army that they will meet such commitments;

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of the County of Humboldt give, and it

does hereby give, assurances to the Secretary of the Army that it will:

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

(b) hold and save the United States free from damages due to the construction work;

(c) maintain and operate the project after completion in accordance with regulations prescribed by the Secretary of the Army;

(d) prescribe and enforce regulations for prevention of encroachment on areas required for ponding of interior runoff;

(e) contribute in cash, or equivalent work, 22.3 percent of the total cost of construction, which said 22.3 percent is now estimated to be the sum of \$246,000.

BE IT FURTHER RESOLVED that said lands, easements, and rights-of-way will be obtained by October 28, 1958.

BE IT FURTHER RESOLVED that said 22.3 percent of construction cost cash contribution, now estimated at \$246,000, will be made on October 28, 1958.

The preceding resolution is presented hereinafter as Exhibit "E".

7. SEMIANNUAL REPORT

Attention is directed to paragraph 208.10(a)(6) of the Flood Control Regulations (inclosed with this manual as Exhibit "A") which states that it will be the duty of the responsible supervising county official, hereinafter referred to as the Superintendent, to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works. The report should be submitted within a ten-day period, prior to 1 June and 1 November of each year, and should include all dated copies of reports of inspections made during the period of report. The report should also include the nature, date of construction and date of removal of all temporary repairs, and dates of permanent repairs. In accordance with the regulations, inspections will be made prior to the beginning of the flood season and, otherwise, at intervals not to exceed 90 days. Immediate steps shall be taken to remedy any adverse conditions disclosed by such inspections. The check lists shown in Exhibit "C" should be used in each inspection to insure that no feature of the protective system is overlooked. Items requiring maintenance should be noted thereon; if items are satisfactory, they should be so indicated by a check.

8. ENTRY PERMITS

Entry permits for the project were furnished by the County of Humboldt by letter dated 8 July 1959. A copy of the letter and the certification of the Board of Supervisors is given in Exhibit "F".

MAINTENANCE AND OPERATION

9. PURPOSE

The purpose of this manual is to assist the responsible local authorities in carrying out their obligations through provision of information and advice as to the operation and maintenance requirements of the project.

10. REGULATIONS

Title 33, Part 208.10 of the Code of Federal Regulations contains rules for the operation of local flood protection works approved by the Secretary of the Army in accordance with authority contained in Section 3 of the Flood Control Act of 22 June 1936 (49 Stat., 1571), as amended and supplemented. Paragraphs quoted hereinafter in this manual are taken from these regulations. A copy of the regulation will be found in Exhibit "A". Compliance with these regulations is one of the requirements of local cooperation. Applicable portions of the regulations are quoted as follows:

" (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 Engineers 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."

11. DUTIES OF SUPERINTENDENT

In line with the provisions covered by the regulations, the general duties of the Superintendent should include the following:

a. Training of key personnel. Key personnel should be trained in order that regular maintenance work may be performed efficiently and to insure that unexpected problems related to flood control may be met in

an orderly manner. The Superintendent should have available the names, addresses, telephone numbers of all his keymen and a reasonable number of substitutes. These keymen should, in turn, have similar data on all of the men that will be necessary for assistance in the discharge of their duties. The organization of keymen should include the following:

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

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

b. Streamflow stages. Floods in the Eel River basin rise very rapidly, the peak occurring after one or two days of heavy rainfall. This allows the Superintendent little time to prepare for flood stages, and he should therefore be cognizant of flood-producing weather forecasts for the Eel River basin. Permanent arrangements should be made with the United States Weather Bureau, Post Office Building, Eureka, California, to secure streamflow stages and forecasts of streamflow stages and weather conditions on affected streams and drainage areas to plan adequate measures of protection.

12. EEL RIVER AT SANDY PRAIRIE LEVEES

a. Description.

(1) The project consists of a 21,188-foot long earthen levee along the right bank of the Van Duzen River, the right bank of the Eel River, and the left bank of Strongs Creek. A section of levee 4,643 feet long was constructed in 1958 during the first phase of construction. This section of levee was incorporated into the final project during the second phase of construction in 1959 and the height of the levee raised to meet the phase two construction profile.

For convenience of survey, two sets of stationing were used during phase two construction. Point of intersection for the two sets of stationing is at the beginning of the phase one levee where station "A" 68+28.86 equals station "B" 45+96.67.

The project levees are constructed of streambed material with a 12-foot wide impervious fill core. The impervious fill core has a 2-foot cover of streambed material at the crown. All riprap is carried 5 feet below existing channel bottom. Where the first phase levee was raised, the impervious core is about 8 feet deep below the new levee crown and then is 12 feet thick (measured horizontally) down the back slope to existing ground. The depth of impervious core varies with the

ground level at all other levee sections. All landside levee slopes are constructed to a $2\frac{1}{2}$ horizontal on 1 vertical, except as otherwise noted. Riverside slopes vary with location of section.

Project station "A" 0/00 is located on the left bank of Strongs Creek, west of the Northwestern Pacific Railroad tracks and north of Ferry Road. Between station "A" 0/00 and station "A" 34/50 the levee is constructed with side slopes of 1 vertical on 3 horizontal on the riverside. (Note: Hereinafter, the designation "horizontal" and "vertical" will be omitted and slopes will be referred to as 3 on 1). Within this reach the levee generally follows Strongs Creek in a northwesterly direction. Beginning at about station "A" 34/00 the levee turns southward along the Eel River. Riprap protection of the riverside slope begins at station "A" 34/50. The riprap is 12 inches thick where placed above water and 18 inches thick where placed below water. Between station "A" 34/50 and station "A" 36/00 the toe of the riprap is transitioned from existing ground down to elevation 25.18 feet. The toe of the levee from station "A" 36/00 to station "A" 68/29 is as shown on Sheet 3 of Exhibit "B".

Beginning at station "A" 66/29 the riprap is transitioned to meet the riprap placed on the levee constructed under the first phase. The levee slope varies between the crown and a point 11 feet down from the crown (measured vertically) and then continues at 1 on 2.25 to the toe. Within this section the riprap placed below water is 23 inches thick. The transition section of levee is 200 feet long and ends at station "A" 68/29, where it joins the existing levee. Levee station "B" starts at this point. From station "B" 45/97 to station "B" 92/40 the levee constructed under the first phase has been raised to meet the profile of the phase two construction and the riprap extended to the top of the levee. The impervious core for this section was described previously. Between station "B" 92/40, the end of the phase one levee, and station "B" 93/50 a transition section has been constructed. Within this transition section both sides vary as to slope. The riprap is 18 inches thick except when placed below water where it is 22 inches thick. From station "B" 93/50 to the end of the levee at station "B" 189/57, the riverside slopes are 1 on 3 and the levee is not riprapped. At station "B" 154/00 the levee turns southeasterly along the Van Duzen River and joins Highway U. S. 101 at about station "B" 184/90. The levee continues on the upstream side of Highway U. S. 101, ending at the Northwestern Pacific Railroad tracks at station "B" 189/57.

b. Maintenance.

(1) General. An integral part of the maintenance program is the need for proper inspection as well as restorative work. As stated under "Duties of the Superintendent", a semiannual report to the District Engineer is required within the ten-day period prior to 1 June and 1 November of each year. In accordance with the regulations, inspections are to be made prior to the beginning of the flood season (1 October to 1 May), immediately following each major flood, and at intervals not to exceed

"(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."

Additional maintenance measures which are to be taken are as follows:

(a) The grade of the levees should be checked to be sure that settlement or sloughing has not lowered the protective height of the levee. Sheets 2 through 10 of Exhibit "B" give the levee profile which can be used for this purpose. In all cases where the levee grade or side slopes do not meet the original contract specifications, fill material similar to that used in the original construction should be used to bring the levee up to original design and cross section. All objectionable material and debris should be removed and the levee surface scarified to a depth of approximately 6 inches prior to placing the new fill. All new material should be placed and compacted in layers.

(b) All displaced riprap shall be replaced as soon as possible after the recession of the damaging waters.

(c) Surfaces of the levee roads and access roads shall be maintained by periodic grading. All holes, soft areas, and damaged road surfaces shall be repaired annually. Unsatisfactory materials shall be cleaned out to firm undisturbed materials, replaced with similar materials and thoroughly compacted.

(d) Trees, brushes, shrubs, or other vegetation with heavy stem or large trunk and root systems shall not be allowed to grow on the levees. The methods used to remove or retard such growth prior to the flood season may be through use of chemical sprays or cutting close to the surface of the riprap or other levee surface.

c. Operation. Operation of the levees shall be in accordance with paragraph 208.10(a) General, (see paragraph 10 of this manual) and paragraph 208.10(b)(2) which states:

"(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."

Additional operational measures to be taken are as follows:

(1) Continuous observation will be made at the Northwestern Pacific Railroad and Highway U.S. 101 bridges across the Van Duzen River overflow channel to be certain that all floating debris passes under the bridges and does not cause a jam. Debris which lodges at a bridge will be removed by truck crane or similar equipment.

(2) Continuous observation will be made for damage to the landside slopes of the levee which may result from wave action in the large ponding area between station "B" 50/00 and station "B" 90/00. Corrective action will be taken as described in paragraph 14 g (3).

13. INTERIOR DRAINAGE SYSTEM

a. Description. Through a system of culverts, drainage ditches, and toe trenches, interior drainage water is carried from the levee back slopes and surrounding area through the levee into the river. All culverts leading through the levee are equipped with flap gates (Waterman) and reinforced concrete headwalls on the riverside of the levee. The inlets on the landside of the levee are riprap protected. The single culvert through the Alton Road access ramp has a reinforced concrete headwall at both the inlet and outlet sides. All culverts are constructed using bituminous coated corrugated metal pipe, placed on a 0.5 percent slope with invert elevations as shown in Table 1 hereinafter.

Four ponding areas are provided back of the levee to collect runoff when the river is at flood stage. The ponding areas are located as follows: (a) along the south side of Sandy Prairie Road about station "B" 114/00; (b) the area immediately behind the levee between station "B" 50/00 and station "B" 90/00; (c) and (d) two areas, one on either side of Sandy Prairie Road at the north end of the project at about station "A" 16/00 and station "A" 19/00. An auxiliary levee has been constructed along the left (west) bank of Mill Creek, a tributary of Strongs Creek. This levee extends from Highway U. S. 101 northerly to Ferry Road and thence along Ferry Road to the Northwestern Pacific Railroad.

Culvert No. 1 at station "B" 187/74 carries the interior drainage water from a small area bounded by Highway U. S. 101, Alton Road, and the Northwestern Pacific Railroad fill. The inlet elevation is 58.00 feet.

Culvert No. 2 carries interior drainage water from an existing four-foot deep ditch along the south side of Alton Road, through the Alton Road access ramp. The culvert empties into a 4,330-foot long trapezoidal drainage ditch starting at about station "B" 157/95 and ending at station "B" 114/65. The ditch is constructed with 1 on 4 side slopes and has a 10-foot bottom width. This drainage ditch carries all the interior drainage water from the area bounded by the project levee, the south extension of Sandy Prairie Road and Highway U. S. 101. It discharges into Culvert No. 3 at invert elevation 44.00 feet and is carried through the project levee in three 36-inch corrugated metal pipes to discharge at elevation 43.50 feet. Beginning at elevation 43.50 feet, a discharge ditch about 15 feet wide, with 1 on 4 side slopes, carries the water at a slope of 0.5 percent to daylight at the end of the bench on the riverside of the levee. The side slopes of the ditch are paved with cobblestone riprap.

Between the southern extension of Sandy Prairie Road and station "B" 90/00 (beginning of ponding area) the slope of natural ground carries runoff away from the levee eastward and then north into the ponding area. This ponding area stores the runoff from the area bounded by Ferry Road on the north, the new levee and Highway U. S. 101 to the east, and the southern extension of Sandy Prairie Road to the south. Water is drained from this

ponding area by Culvert No. 4, which is located at station "B" 54/00. Culvert No. 4 consists of two 48-inch pipes with the inlet placed at elevation 33.00 feet.

Beginning at station "A" 68/29, a two-foot wide toe trench was constructed 5 feet out from the landside toe of the levee. The toe trench is filled with streambed sand and gravel and drains the back slope of the levee and adjacent natural ground. The toe trench is daylighted about station "A" 34/50.

Culvert No. 5 consists of one 36-inch pipe located at station "A" 19/05. The inlet elevation is 38.50 feet and the culvert drains an area bounded by the levee and the northern extension of Sandy Prairie Road.

Culvert No. 6 is located at station "A" 16/70 and the inlet invert elevation is 38.50 feet. This culvert drains the runoff from the area bounded by the northern extension of Sandy Prairie Road, the levee and Ferry Road.

Table 1

DRAINAGE STRUCTURES

Culvert No.	Project Station	Inlet Invert Elevation in feet (above MLLW)	Description
1	"B" 187/25	58.00	1 - 44' long 24" dia. CMP w/flap gate
2	"B" 157/95	49.50	1 - 30' long 36" dia. CMP w/o flap gate
3	"B" 114/10	44.00	3 - 102' long 36" dia. CMP w/flap gates
4	"B" 54/00	33.00	2 - 104' long 48" dia. CMP w/flap gates
5	"A" 19/05	38.50	1 - 80' long 36" dia. CMP w/flap gate
6	"A" 16/70	38.50	1 - 72' long 30" dia. CMP w/flap gate

b. Maintenance.

(1) General. Inspection and maintenance of the interior drainage system will be accomplished in accordance with the inspection schedule outlined heretofore under the section titled "Eel River at Sandy Prairie Levees" (Section 12b (1)).

(2) Culverts. Inspection and maintenance of the culverts shall be in accordance with paragraph 208.10(a), General (see paragraph 10 of this manual) and paragraph 208.10(d)(1) which states:

"(d) Drainage structures--(1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

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

"(ii) Inlet and outlet channels are open;

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

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

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

In addition to the prescribed inspection and maintenance program, the following measures are to be taken:

(a) All culverts shall be inspected prior to the flood season and all obstructions removed.

(b) All nuts and bolts on flap gate assemblies shall be inspected to determine whether or not they are sufficiently tight and the hinges are operating freely.

(3) Ditches. Inspection and maintenance of all ditches shall be in accordance with paragraph 208.10(d)(1) as quoted in paragraph b(2) above.

c. Operation.

(1) General. The interior drainage system is intended to function under gravity flow. When the water surface of the Eel River or

Strong's Creek becomes high enough to close the flap gates, it is intended that the drainage water be ponded behind the levee until the river or creek recedes, thereby allowing the flap gates to open again.

(2) Culverts. Operation of culverts and attendant drainage ditches shall be in accordance with paragraph 208.10(d)(2) which states:

"(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."

SUGGESTED METHODS OF COMBATING FLOOD CONDITIONS

14. APPRAISAL OF PROBLEMS

Most of the methods described hereinafter have been developed during years of experience with the various problems that often develop 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. If problems not covered by these suggestions arise, where the Superintendent is in doubt as to the procedures to be taken, he will be expected to consult the District Engineer, U.S. Army Engineer District, San Francisco, California, and follow standard engineering practice in meeting the situation. It should be noted that it is much better to be overprepared 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 protective system in time of emergency.

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

b. Premeditated damage. The Superintendent should continually guard against premeditated damage to the levee.

c. Security. Personnel of the Corps of Engineers, U. S. Army, whether military or civilian, are not vested with any civil police authority in 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. In the event local law enforcement agencies prove inadequate, local interests can request the aid of State forces, and if additional support becomes necessary, Federal troops can be requested as provided by law.

d. Inspection of flood control works. Immediately upon receipt of information that 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:

- (1) Sector limits -- ascertain that the dividing line between sectors is plainly determined and, if necessary, marked.
- (2) Condition of new levees and recent repairs.
- (3) Condition of culverts, flap gates, and protective riprap at inlets.
- (4) Transportation facilities -- roads and rail.
- (5) Material supply -- quantity, location and condition.
- (6) Communications -- locate and check all necessary telephones in the vicinity of the levee.

e. 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:

(1) Fill up holes or washes in the levee crown and slopes. 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.

(2) 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 levee toe-ditches. 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.

(3) Repair and close all flap gates on culverts and see that they are seated properly before they are covered with floodwaters.

(4) Ascertain that all roads to and along the levee are in a good state of repair.

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

(6) Check and obtain repair of all telephone lines necessary for operation, obtain lists of all team forces, motorboats, motorcars, and truck transportation that can be made available.

(7) Make thorough arrangements with reliable sources for the supply, transportation, subsistence, and shelter for the necessary labor.

(8) 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.

(9) Remove all dynamite and explosives of any kind from the vicinity of the levee.

f. Disaster relief. It is the responsibility of local, State and 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.

g. 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 proven effective during many years of use by the Department of the Army.

(1) 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 when seepage appears. They 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 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 drains.

(2) 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 discharging from the boil (see Exhibit "D", 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 sub-levee 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.

(3) 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 an 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 washouts are beginning. Sections of cotton bagging should be placed over the washed areas, as shown on Exhibit "D", Plate 3. As an alternative, filled sacks should be placed in lieu of the bagging 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. Exhibit "D", Plate 2, shows a movable type of wash protection also used

with good results. Its advantage is that it can readily be built at any convenient location and easily set in place on the job.

(4) Scours. A careful surveillance should be made of the river-side of the levee at all localities where high current velocities are observed. Trouble may be looked for at places where pipes, sewers, and other structures penetrate the levee. The approved method of construction to check scour on the slopes is 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.

h. Topping. Immediate consideration should be given to the grade line of each levee section by comparison of existing grades with those shown on Exhibit "B", Sheets 2 through 10. If any reaches show grades below the constructed grade as shown on Exhibit "B", Sheets 2 through 10, emergency topping should be undertaken as follows:

(1) Sack topping. Sack topping may be used to raise the crown of the levee about three feet. The sacks should generally be laid stretch-wise or along the levee for the first layer, crosswise for the second layer, and so on. Sacks should be lapped at least one-fourth either way and well mauled into place. When properly sacked and tamped, one sack will give about three to four inches of topping (see Exhibit "D", Plate 4).

(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 topping, a careful line of levels should be run and grade stakes set in advance. Two-inch by 4-inch by 6-foot long stakes should then be driven on the riverside of the crown six feet apart, and one 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 an additional 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 (see Exhibit "D", Plate 5).

i. Transportation. In instances where it is necessary to send equipment over roads that are impassable due to mud or sand, their passage may be provided by the use of a plank road or by means of steel or wire mats.

j. Check lists. The inspection list in Exhibit "C" may be used as a check list for inspections and also for use in making the required semiannual reports. This list should be used in each inspection to insure that no feature of the protective system is overlooked. Items requiring repairs should be noted thereon; if items are satisfactory, they

should be indicated as such. Reproduction of the check lists is hereby authorized.

k. Liaison with District Engineer and use of Government plant. During periods of emergency, close liaison will be maintained with the Corps of Engineers, whose objective of maintaining the integrity of the flood control works will be attained by supporting local interests in their efforts or by assuming full charge of the flood fight when the problem is beyond the capacities of local interests. The District Engineer, U. S. Army Engineer District, San Francisco, 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.

l. Flood Emergency Manual. The most recent "Flood Emergency Manual" published by the U. S. Army Engineer District, San Francisco, should be used to supplement the information furnished in this Operation and Maintenance Manual.

Title 33—Navigation and Navigable Waters
Chapter II—Corps of Engineers

Part 208—Flood Control
Regulations

Sec.

208.10 Local flood protection works; maintenance and operation of structures and facilities.

§ 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 right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the 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 extent which might affect the stability of the wall or its water tightness;

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

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

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

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

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

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

(d) *Drainage structures*—(1) *Maintenance*. Adequate measures shall be taken to insure that inlet and outlet channels

are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

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

(ii) Inlet and outlet channels are open;

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

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

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

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

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

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

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

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

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

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

(2) *Operation.* Erection of each movable closure shall be started in sufficient

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

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

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

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

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

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

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

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

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

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

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

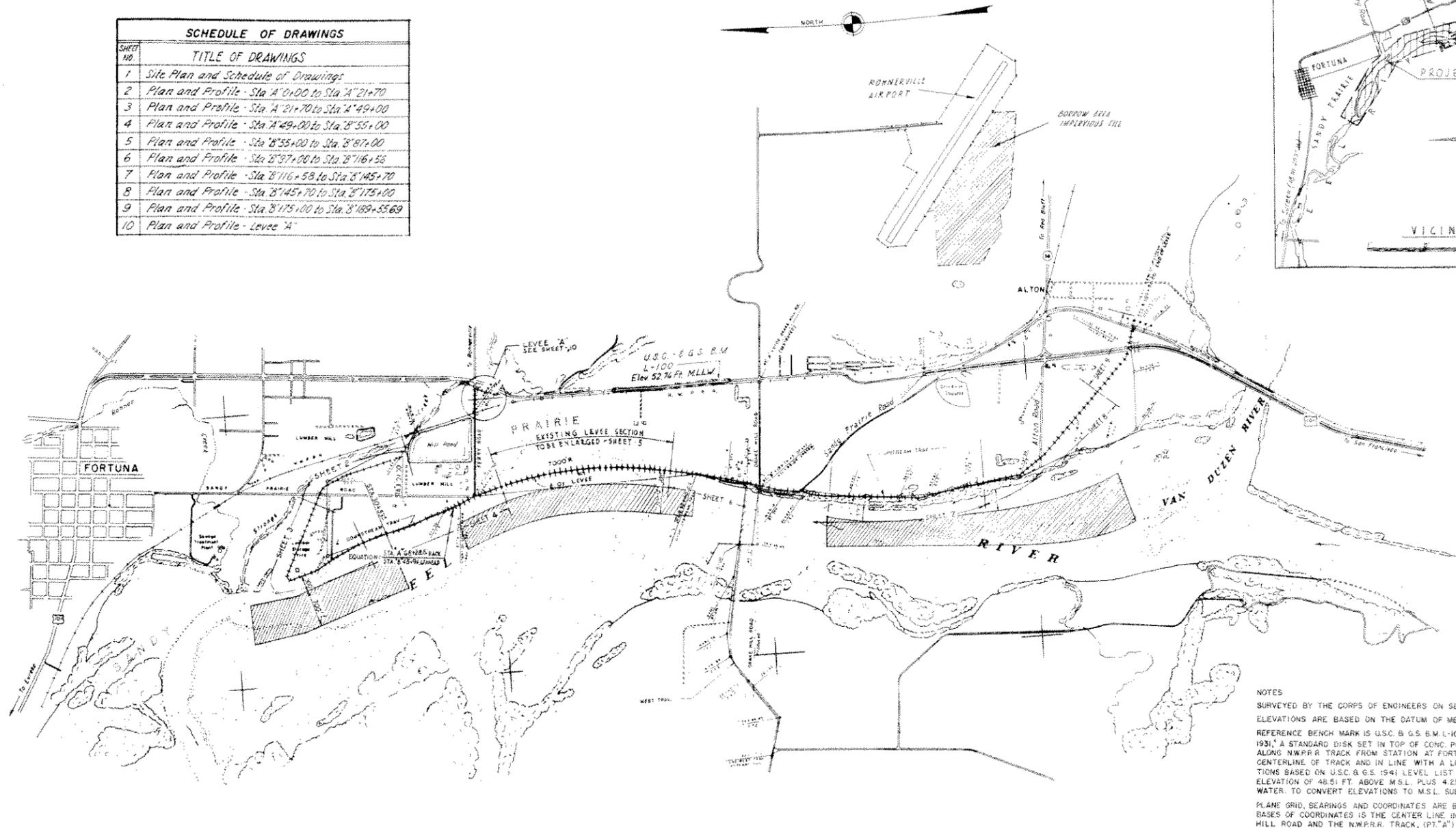
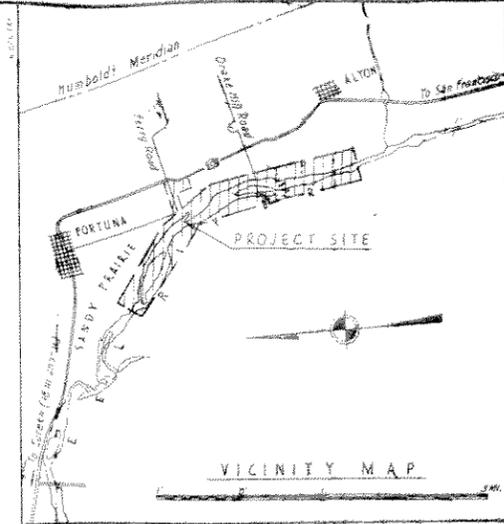
(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become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

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

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

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

SCHEDULE OF DRAWINGS	
SHEET NO.	TITLE OF DRAWINGS
1	Site Plan and Schedule of Drawings
2	Plan and Profile - Sta. A 0+00 to Sta. A 21+70
3	Plan and Profile - Sta. A 21+70 to Sta. A 49+00
4	Plan and Profile - Sta. A 49+00 to Sta. B 55+00
5	Plan and Profile - Sta. B 55+00 to Sta. B 87+00
6	Plan and Profile - Sta. B 87+00 to Sta. B 116+58
7	Plan and Profile - Sta. B 116+58 to Sta. B 145+70
8	Plan and Profile - Sta. B 145+70 to Sta. B 175+00
9	Plan and Profile - Sta. B 175+00 to Sta. B 189+55.69
10	Plan and Profile - Levee 'A'



SITE PLAN



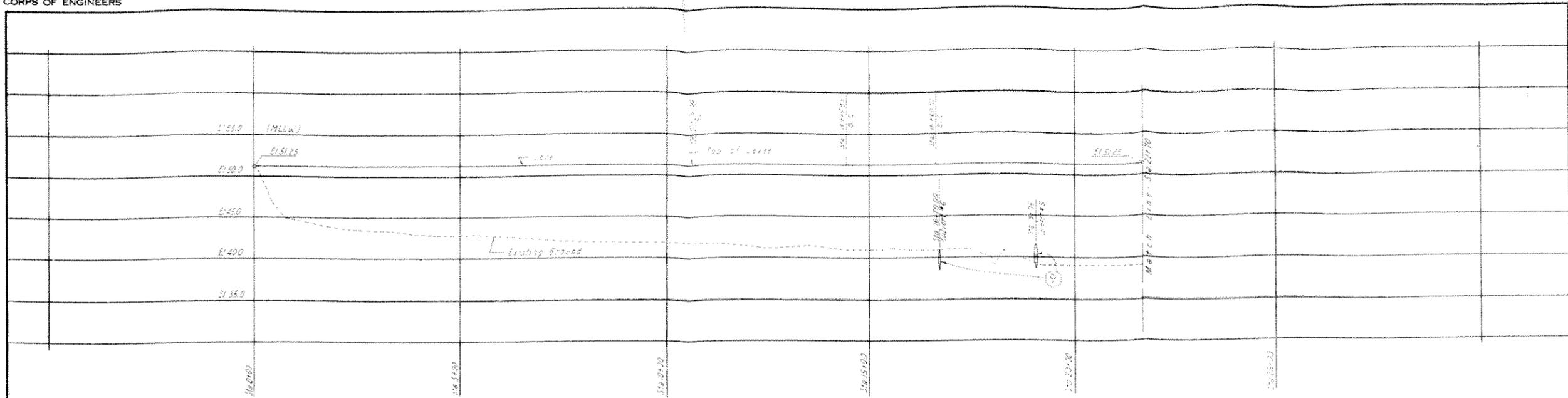
LEGEND

- ++++ LEVEE EMBANKMENT
- BORROW AREA
- - - - CONSTRUCTION R/W
- ⑥ PAY ITEM NO.

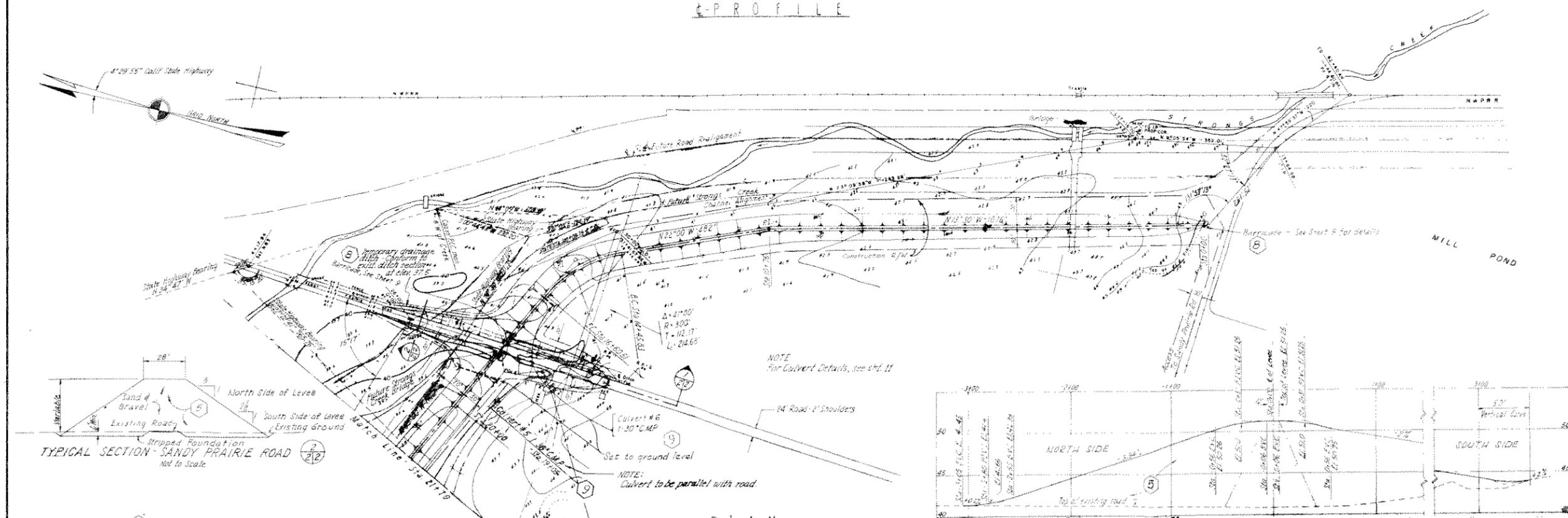
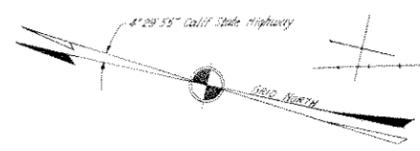
NOTES
 SURVEYED BY THE CORPS OF ENGINEERS ON SEPT-DEC, 1958, JAN-FEB, 1959
 ELEVATIONS ARE BASED ON THE DATUM OF MEAN LOWER LOW WATER
 REFERENCE BENCH MARK IS U.S.C. & G.S. B.M. L-100 STAMPED "46 510 L-100 1931" A STANDARD DISK SET IN TOP OF CONC. POST, LOCATED 2.1 MI. SOUTH ALONG NW P.R.R. TRACK FROM STATION AT FORTUNA, 31 FT. NORTHEAST OF CENTERLINE OF TRACK AND IN LINE WITH A LONG ROW OF TREES ELEVATIONS BASED ON U.S.C. & G.S. 1941 LEVEL LIST FOR B.M. L-100 WITH AN ELEVATION OF 48.51 FT. ABOVE M.S.L. PLUS 4.25+52.76' MEAN LOWER LOW WATER. TO CONVERT ELEVATIONS TO M.S.L. SUBTRACT 4.25 FT.
 PLANE GRID, BEARINGS AND COORDINATES ARE BASED ON LOCAL GRID BASES OF COORDINATES IS THE CENTER LINE INTERSECTION OF DRAKE HILL ROAD AND THE NW P.R.R. TRACK, (PT. 'A') WHICH IS 500,000 N AND 500,000 E. BASES OF BEARINGS IS THE TANGENT OF THE NW P.R.R. TRACK ACROSS DRAKE HILL RD. TRACK ASSUMED TO BE NORTH AND SOUTH.

AS CONSTRUCTED

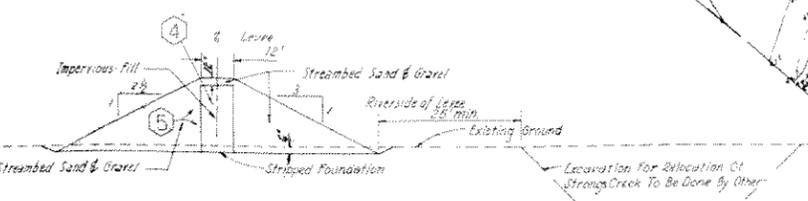
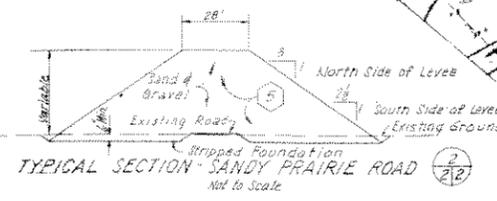
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: H. Y. D.	NUMBLOTT COUNTY CALIFORNIA EEL RIVER FLOOD CONTROL PROJECT OPERATION AND MAINTENANCE MANUAL LEVEE EXTENSION AT SANDY PRAIRIE SITE PLAN & SCHEDULE OF DRAWINGS
TRACED BY:	
CHECKED BY:	
SUBMITTED:	
APPROVAL RECOMMENDED:	APPROVED: DATE: JAN 1961
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO. DRAWING NUMBER SHEET 1 OF 10 60 39 23



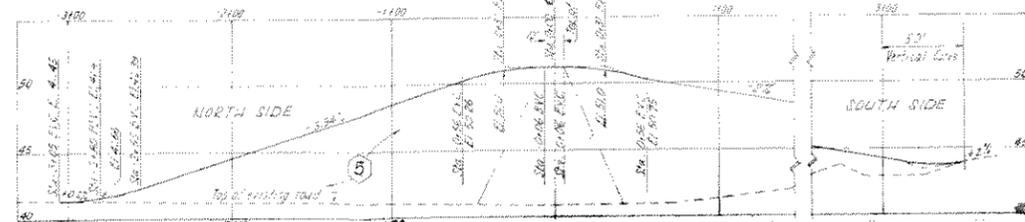
E-PROFILE



PLAN



TYPICAL SECTION
Sta. A+0+00 to Sta. A+34+50
No Scale

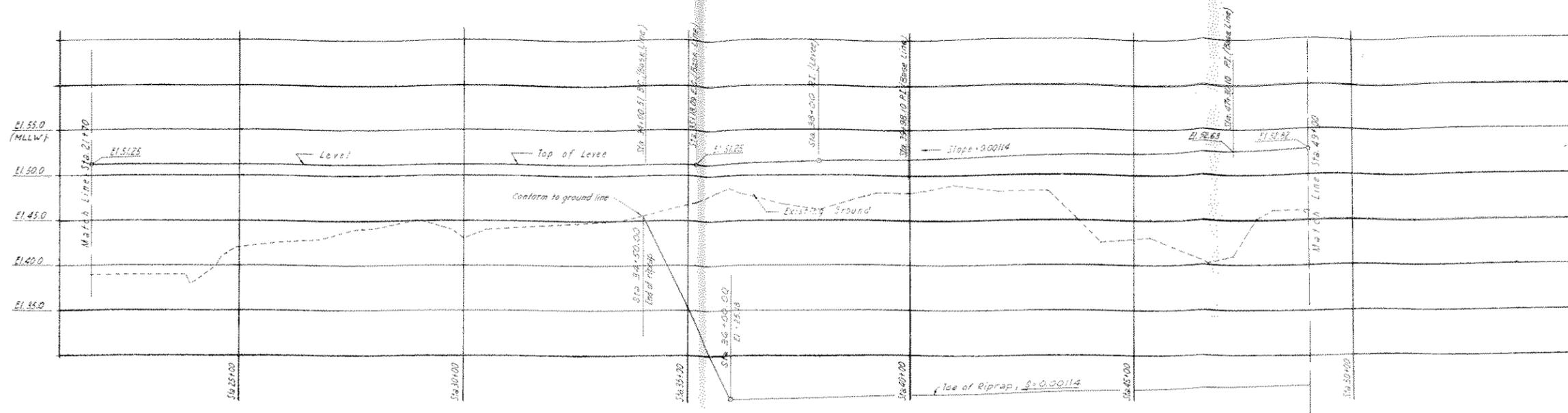


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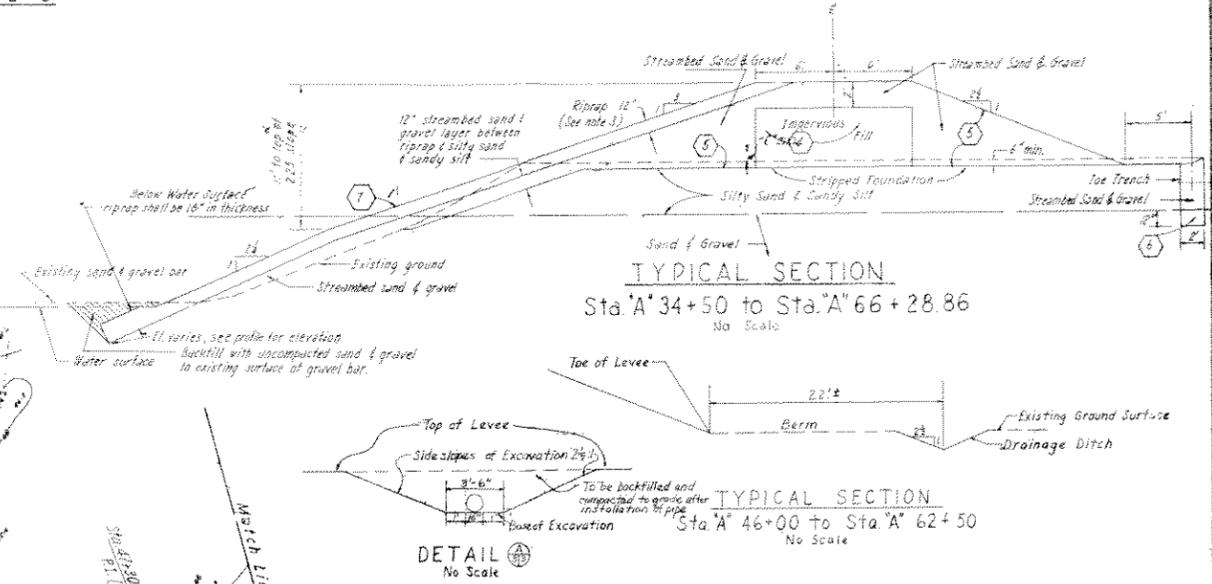
T.B.M. Spike in telephone pole 10' E and 60' north of Sta. 33+75 (Col. E) Elev. 42.44

NOTE:
for culvert details see sheet #1

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
HUMBOLDT COUNTY CALIFORNIA EEL RIVER FLOOD CONTROL PROJECT OPERATION AND MAINTENANCE MANUAL LEVEE EXTENSION AT SANDY PRAIRIE PLAN AND PROFILE STA. "A" 0+00 TO STA. "A" 21+70	
DRAWN BY: J.L.	APPROVED: [Signature]
TRACED BY:	DATE: JAN. 1951
CHECKED BY:	
REVISIONS:	
APPROVAL RECOMMENDED:	
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON DISTRICT ENGINEER	
SCALE: AS SHOWN	JOB NO. [Blank]
DRAWING NUMBER 2 of 10 60 30 23	



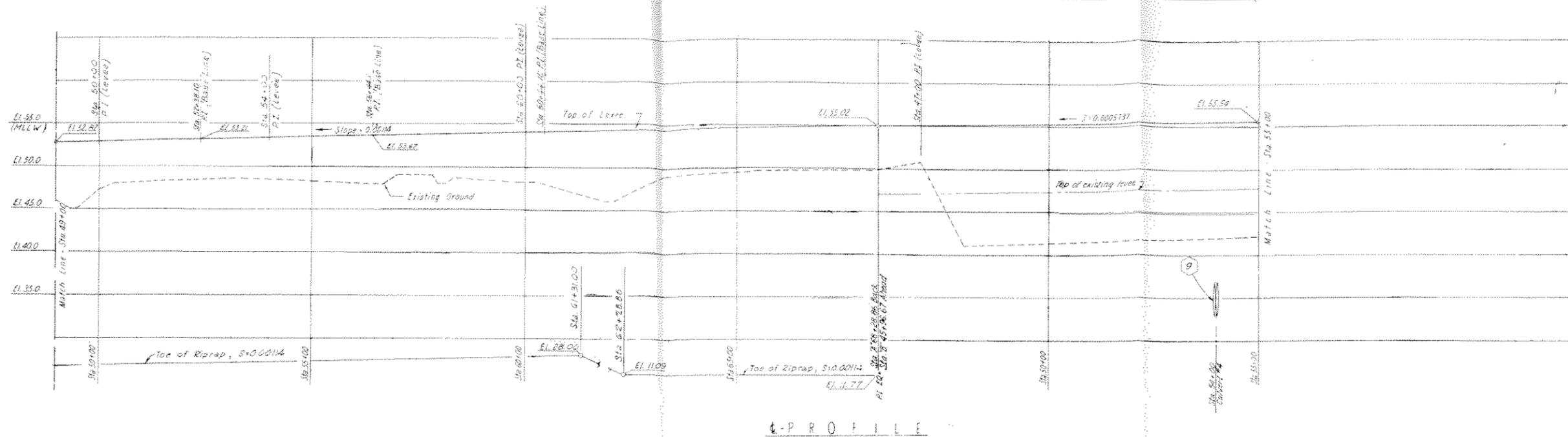
C-PROFILE



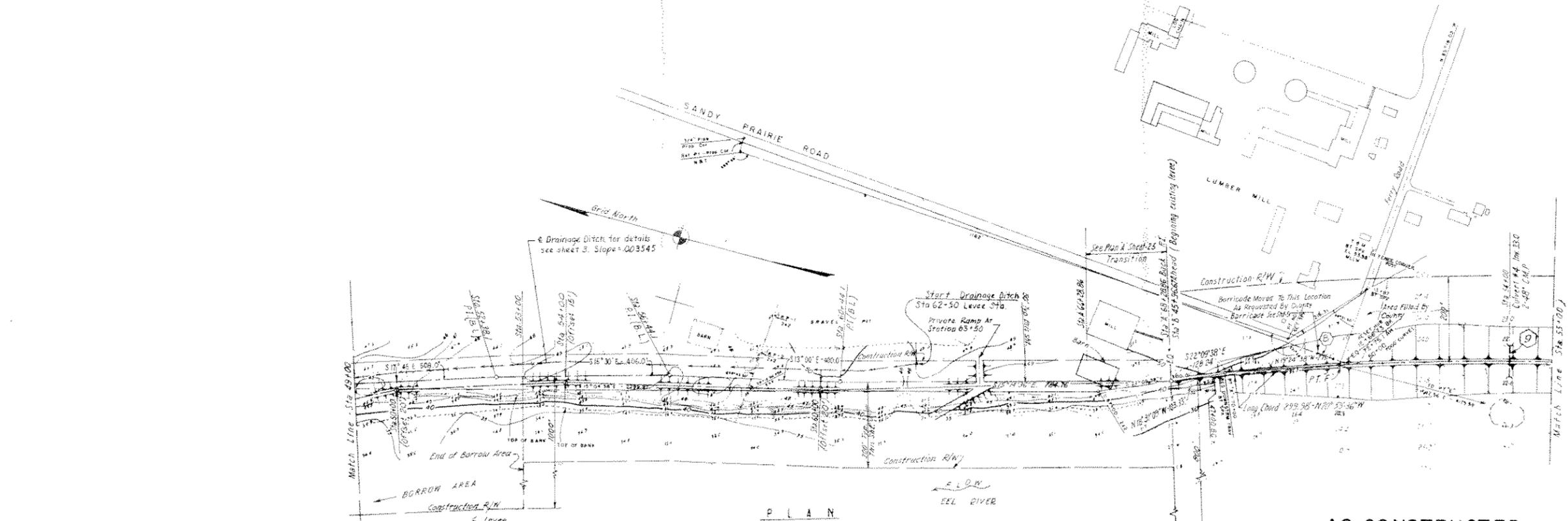
NOTE:
 1. Base Line extends from Sta. 25+00 to Sta. 46+00.00. Levee E' OFF set as shown.
 2. For culvert details, see sheet 71.
 3. Between Sta. A' 42+28.86 and Sta. A' 66+28.86, the thickness of the riprap shall be 15 inches and increased to 23 inches when placed below water surface.

AS CONSTRUCTED

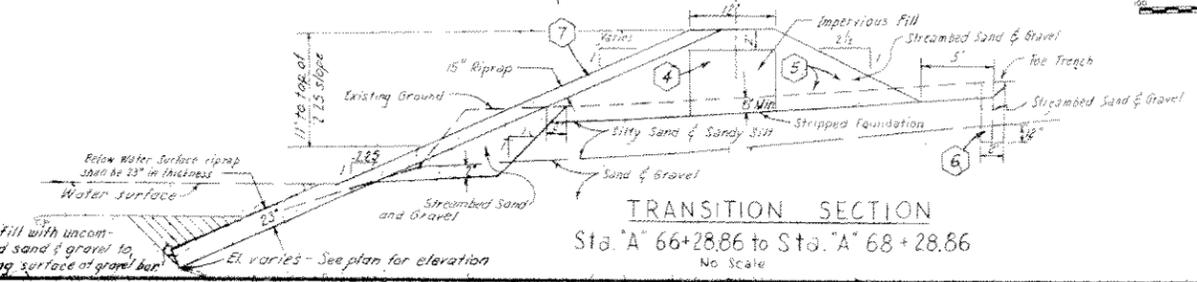
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: J.L.	HUMBOLDT COUNTY CALIFORNIA
TRACED BY:	EEL RIVER FLOOD CONTROL PROJECT
CHARGED BY:	OPERATION AND MAINTENANCE MANUAL
SUBMITTED:	LEVEE EXTENSION AT SANDY PRAIRIE
APPROVAL RECOMMENDED:	PLAN AND PROFILE
DATE: JAN. 1961	STA. "A" 21+70 TO STA. "A" 49+00
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN DRAWING NUMBER SHEET 3 OF 10 60 39 23



E-PROFILE



PLAN



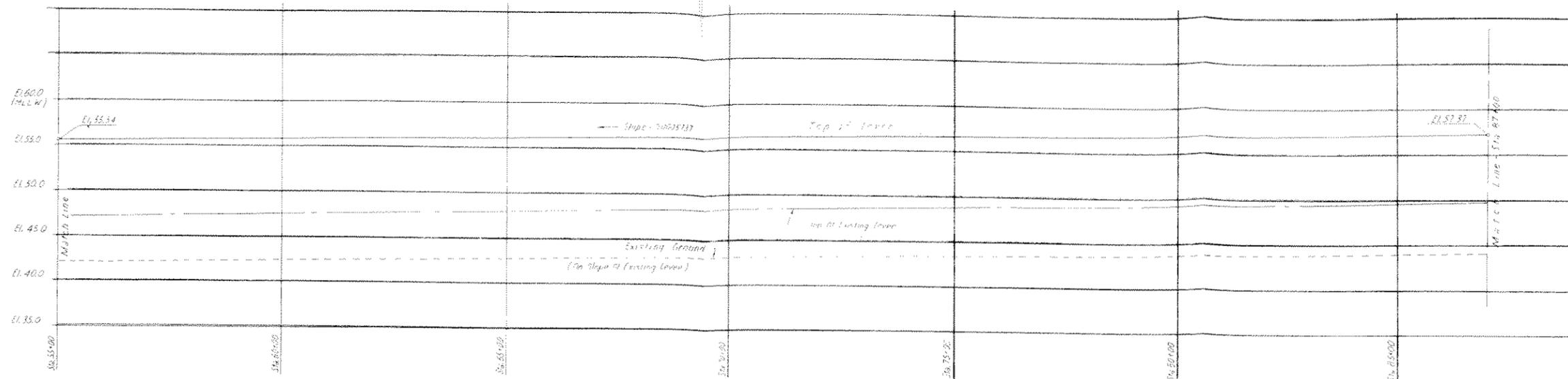
TRANSITION SECTION

Sta. "A" 66+28.86 to Sta. "A" 68+28.86
No Scale

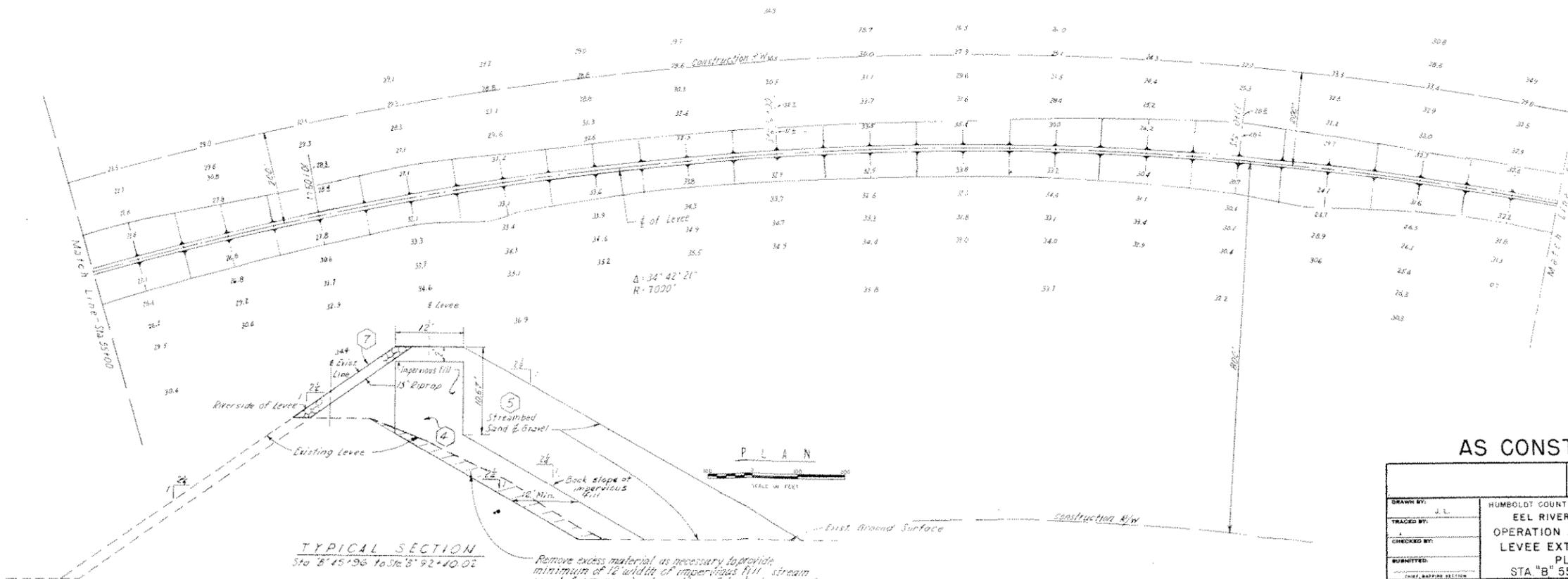
NOTE:
 1- Base Line extends from Sta. 49+00 to Sta. 68+28.86. Levee # Offset as shown.
 2- For culvert details see sheet 11.

AS CONSTRUCTED

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
HUMBOLDT COUNTY CALIFORNIA EEL RIVER FLOOD CONTROL PROJECT OPERATION AND MAINTENANCE MANUAL LEVEE EXTENSION AT SANDY PRAIRIE PLAN AND PROFILE STA. "A" 49+00 TO STA. "B" 55+00	
DRAWN BY: TRACED BY: CHECKED BY: SUBMITTED: DATE PREPARED AND REPORT MADE: APPROVAL RECOMMENDED:	APPROVED: _____ DATE: JAN. 1961
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN DRAWING NUMBER SHEET 4 of 10 60 39 23



PROFILE

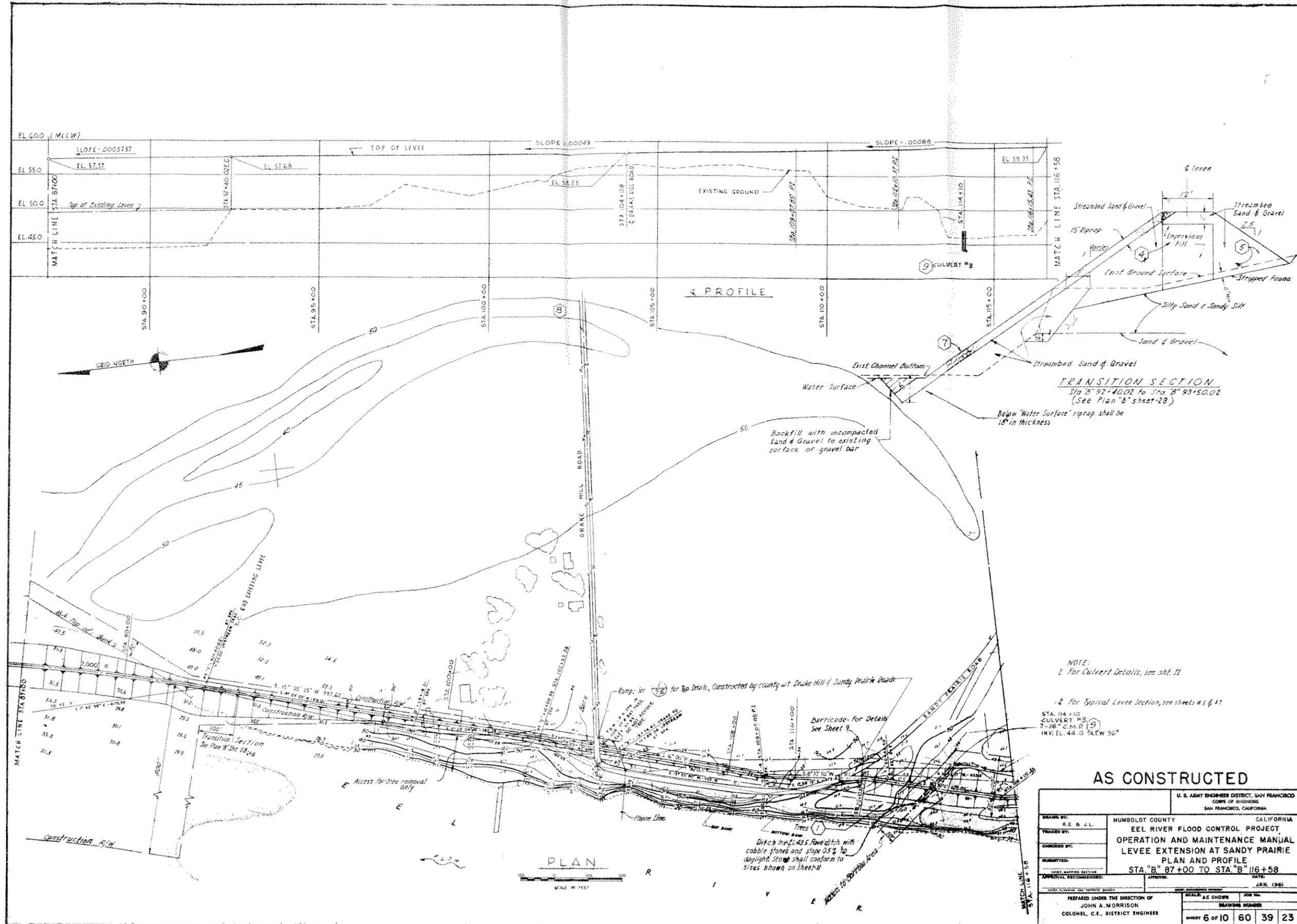


TYPICAL SECTION
Sta. 8'45+98 to Sta. 8'92+40.02

PLAN

AS CONSTRUCTED

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
HUMBOLDT COUNTY CALIFORNIA EEL RIVER FLOOD CONTROL PROJECT OPERATION AND MAINTENANCE MANUAL LEVEE EXTENSION AT SANDY PRAIRIE PLAN AND PROFILE STA. "B" 55+00 TO STA. "B" 87+00	
DRAWN BY: J. L. CHECKED BY: SUBMITTED: APPROVAL RECOMMENDED:	DATE: JAN. 1961
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO.: DRAWING NUMBER: SHEET 5 OF 10 60 39 23



TRANSITION SECTION
 Sta 92+40.02 to Sta 93+50.02
 (See Plan "B" sheet 28)

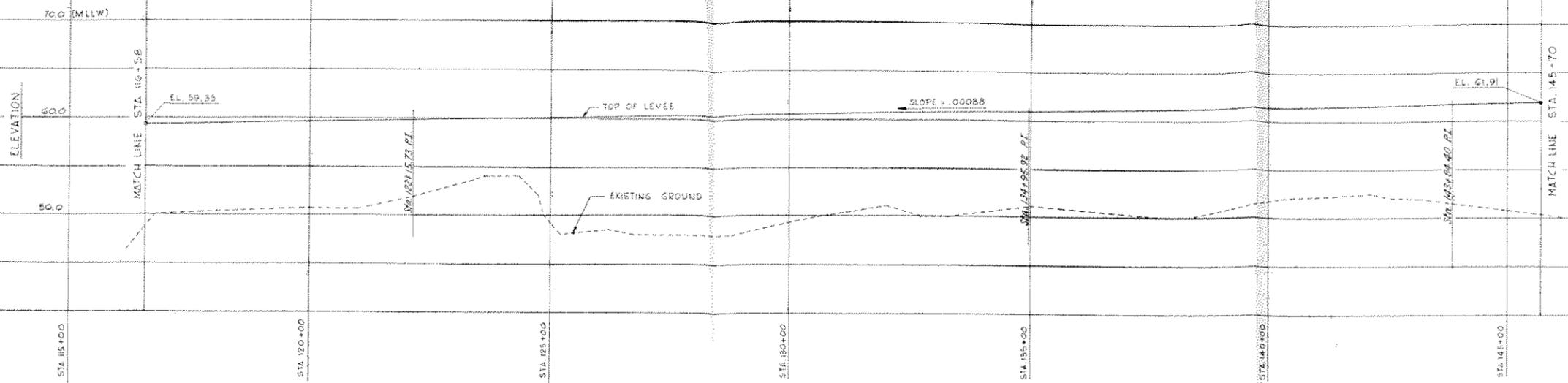
NOTE:
 1. For Culvert Details, see sht. 11
 2. For Typical Levee Section, see sheets #5 & 17

STA. 114+10
 CULVERT #9
 9'-36" C.M. R.
 INV. EL. 44.0 SKEW 36°

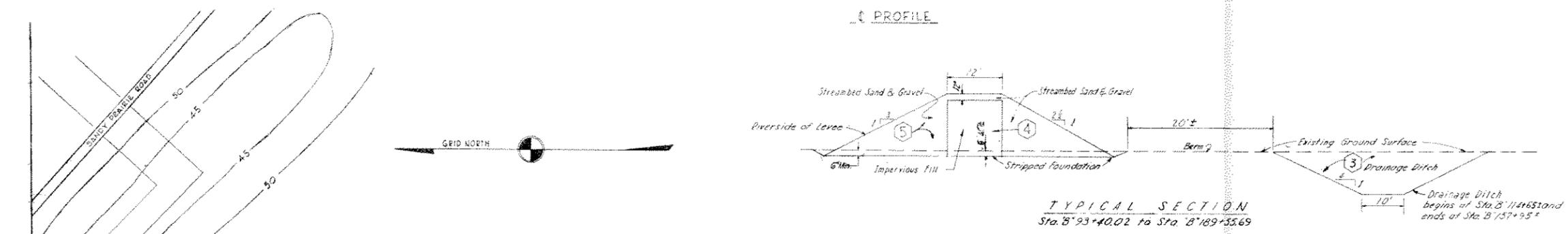
AS CONSTRUCTED

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: H. E. B. J. L.	HUMBOLDT COUNTY CALIFORNIA
DESIGNED BY:	EEL RIVER FLOOD CONTROL PROJECT
CONSTRUCTED BY:	OPERATION AND MAINTENANCE MANUAL
SUBMITTED:	LEVEE EXTENSION AT SANDY PRAIRIE
CORP. MAPPER SECTION:	PLAN AND PROFILE
APPROVAL RECOMMENDED:	STA. "B" 87+00 TO STA. "B" 116+58
DATE: JAN. 1961	
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO. DRAWING NUMBER SHEET 6 OF 10 60 39 23

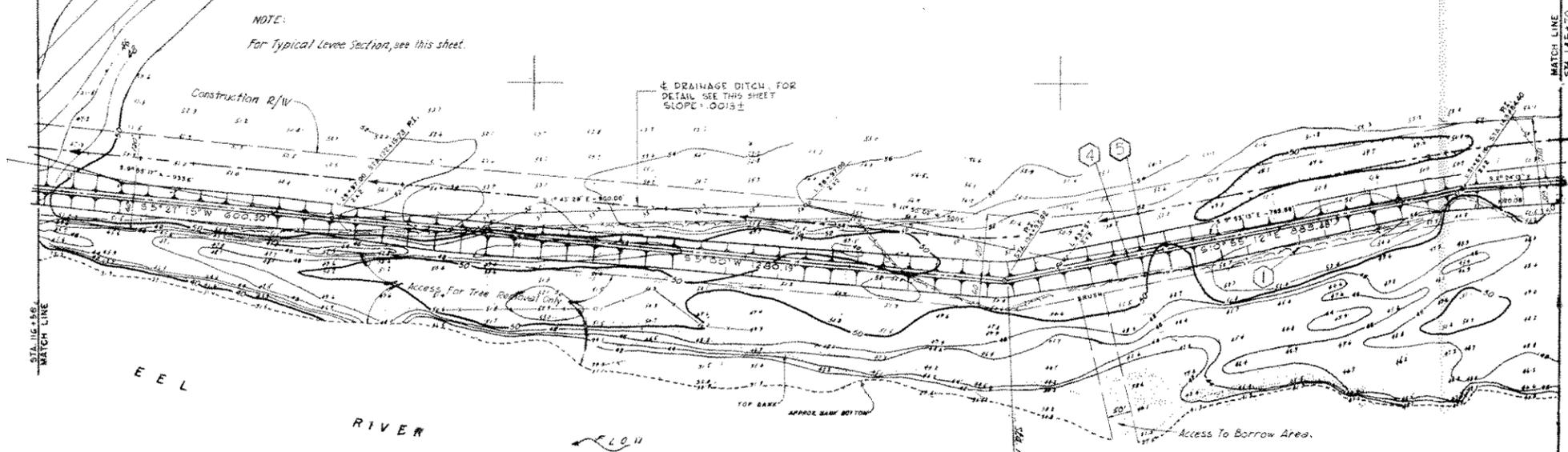
EXHIBIT "B"



PROFILE



TYPICAL SECTION
Sta. B'93+40.02 to Sta. B'109+55.69

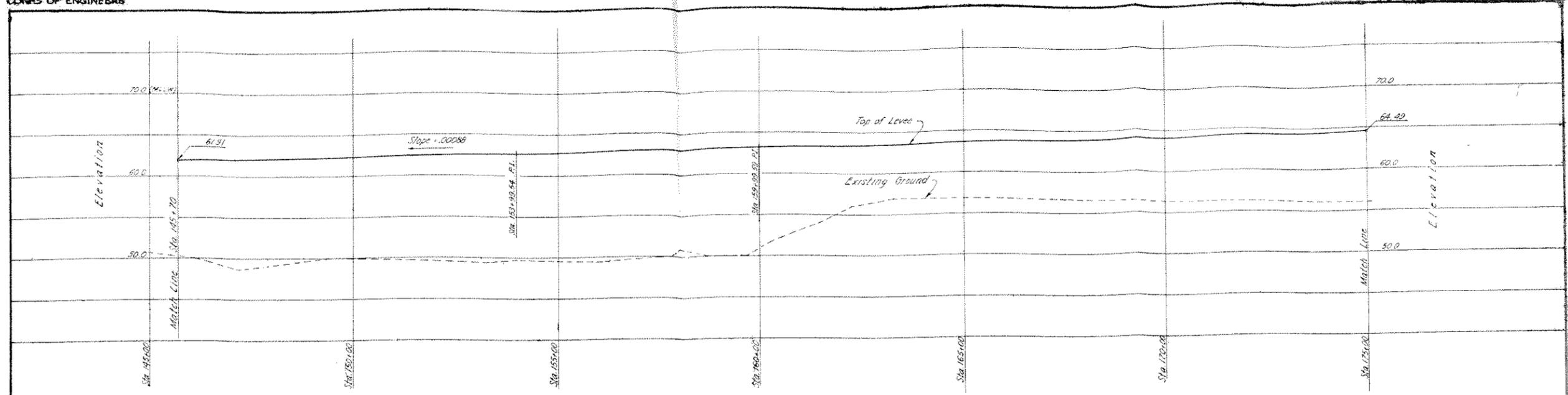


PLAN

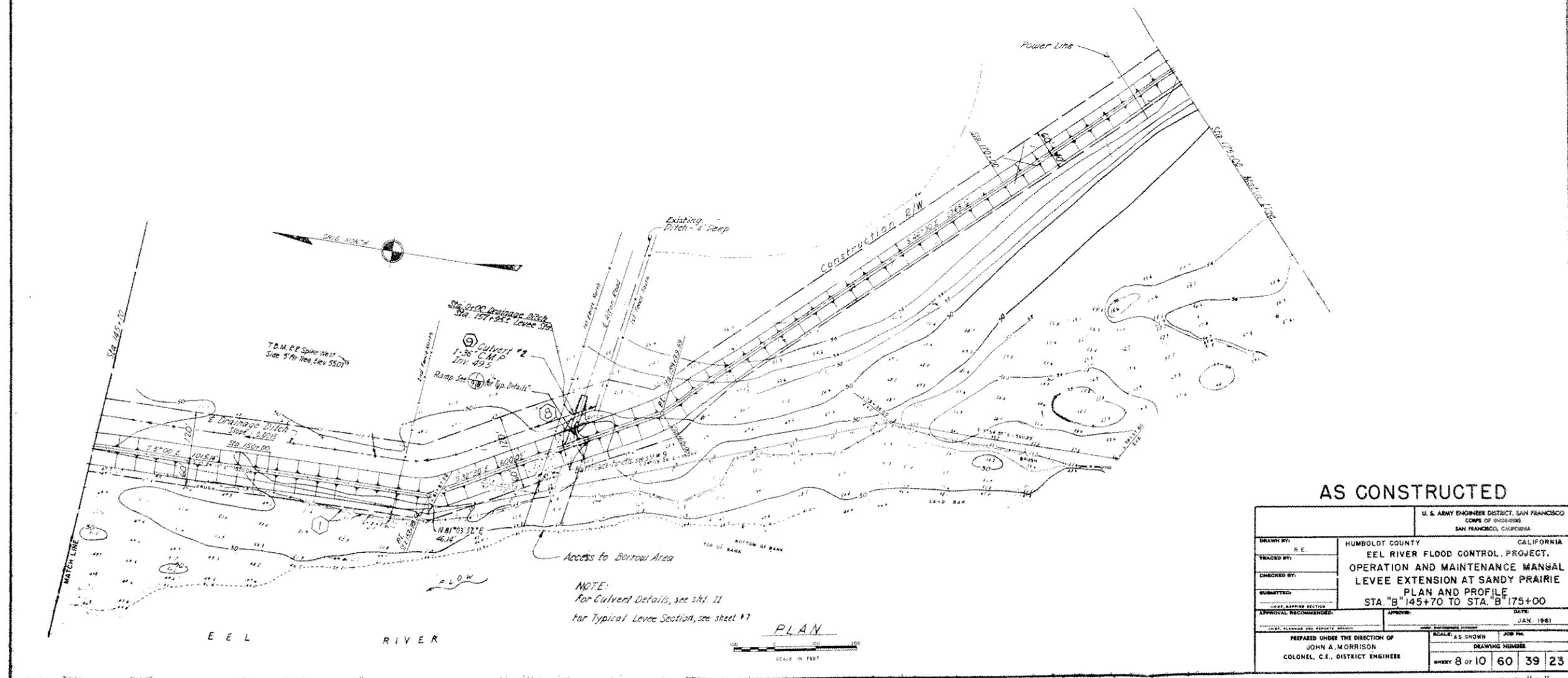


AS CONSTRUCTED

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: J.L.	HUMBOLDT COUNTY CALIFORNIA
TRACED BY:	EEL RIVER FLOOD CONTROL PROJECT
CHECKED BY:	OPERATION AND MAINTENANCE MANUAL
SUBMITTED:	LEVEE EXTENSION AT SANDY PRAIRIE
DESIGNED BY: CHAS. HAPPEL BENTLEY	PLAN AND PROFILE
APPROVAL RECOMMENDED:	STA. B'116+58 TO STA. B'145+70
CHECK, STANDARD AND REPORT SYMBOLS:	DATE: JAN. 1961
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO. DRAWING NUMBER SHEET 7 OF 10 60 39 23



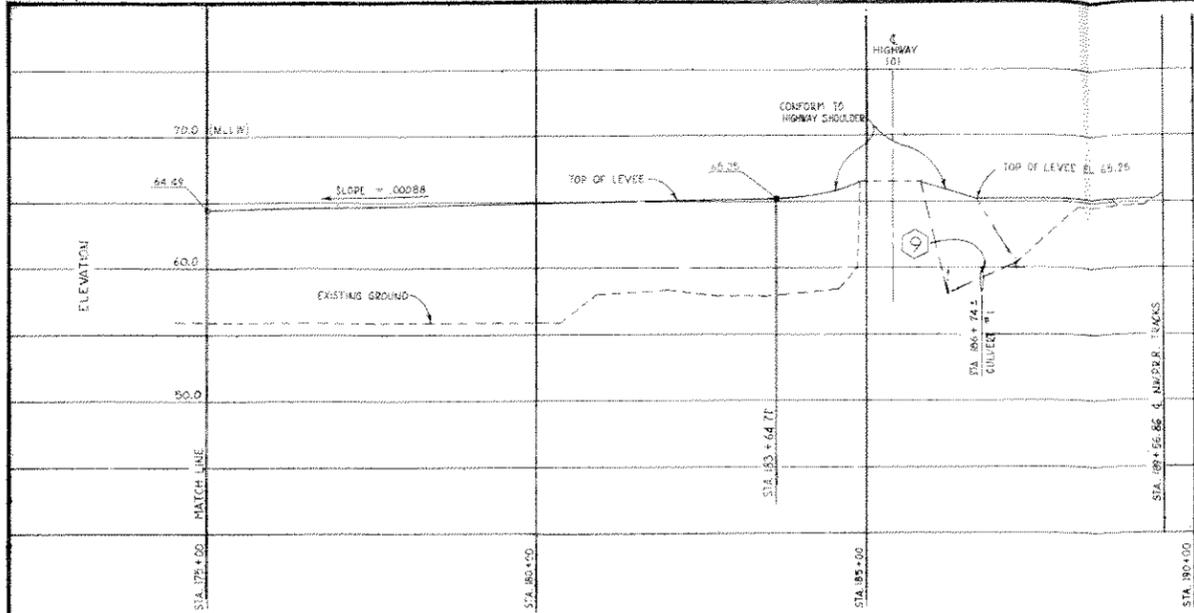
E PROFILE



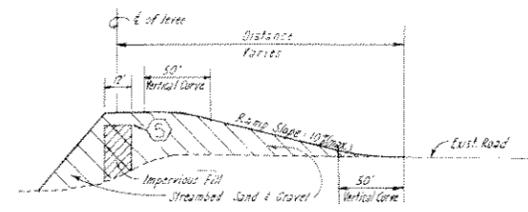
PLAN

AS CONSTRUCTED

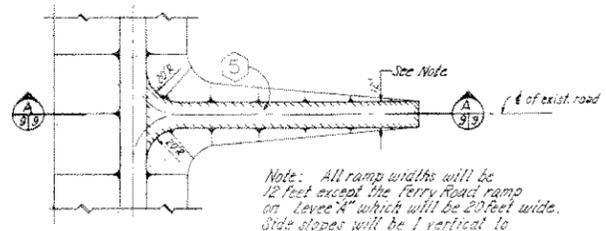
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: R. E.	HUMBOLDT COUNTY CALIFORNIA
TRACED BY:	EEL RIVER FLOOD CONTROL PROJECT.
CHECKED BY:	OPERATION AND MAINTENANCE MANUAL
SUBMITTED:	LEVEE EXTENSION AT SANDY PRAIRIE
APPROVAL RECOMMENDED:	PLAN AND PROFILE
DATE: JAN. 1951	STA. "B" 145+70 TO STA. "B" 175+00
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO. 60 39 23 SHEET 8 OF 10



C PROFILE

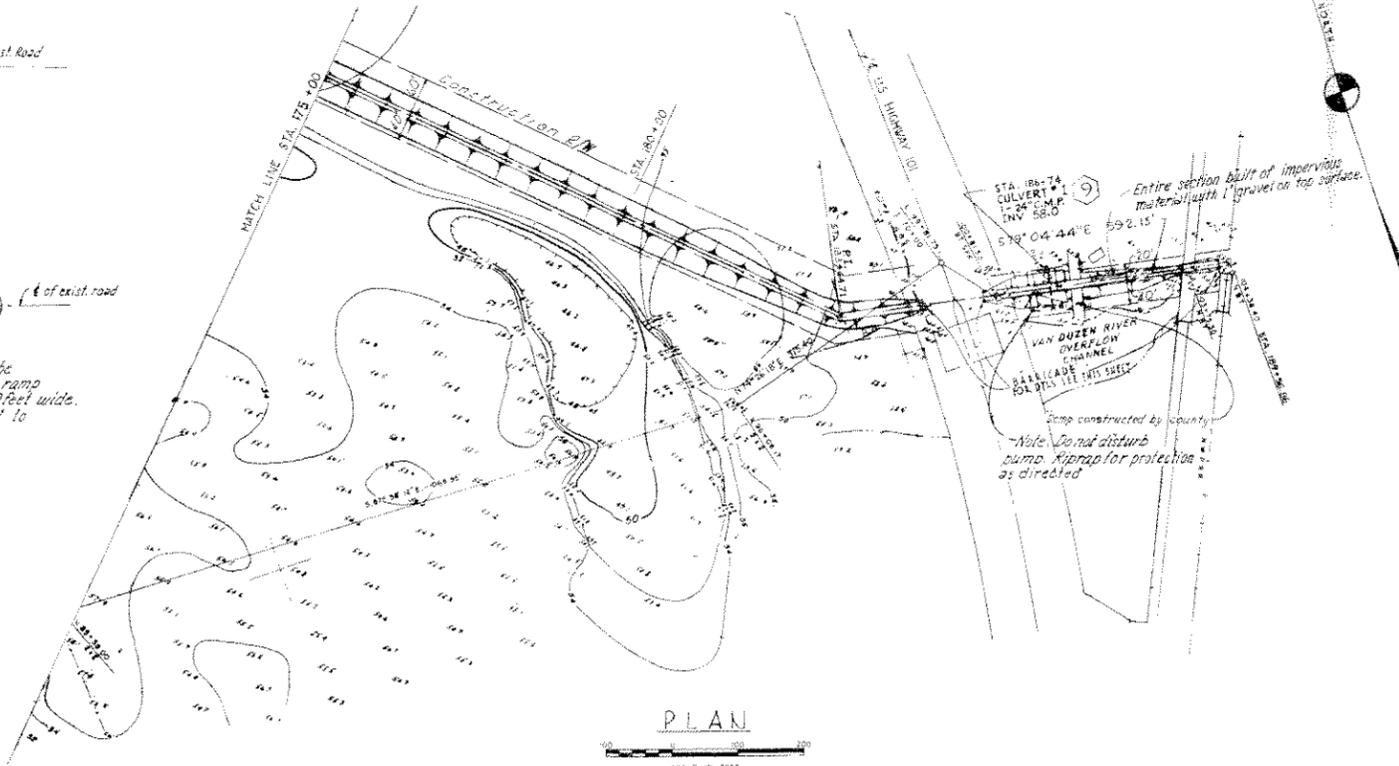


SECTION A-919



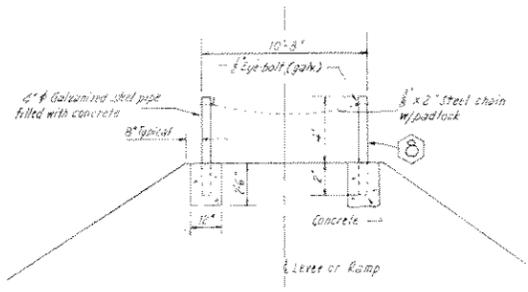
PLAN

TYPICAL RAMP DETAILS NOT TO SCALE



PLAN

SCALE IN FEET

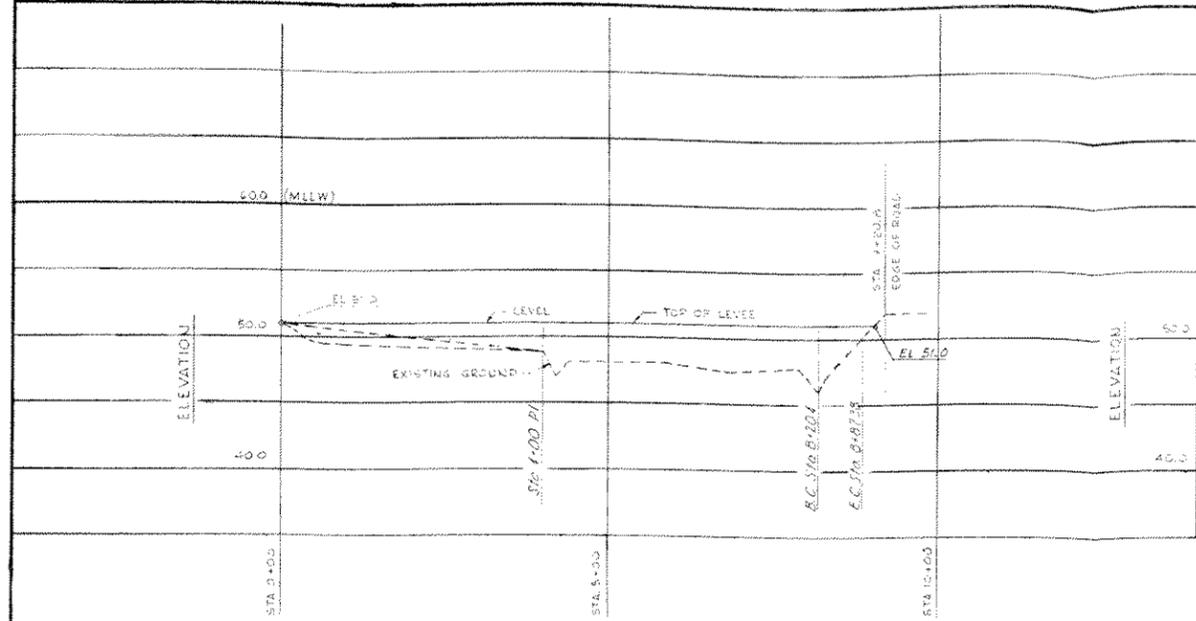


BARRICADE DETAIL NOT TO SCALE

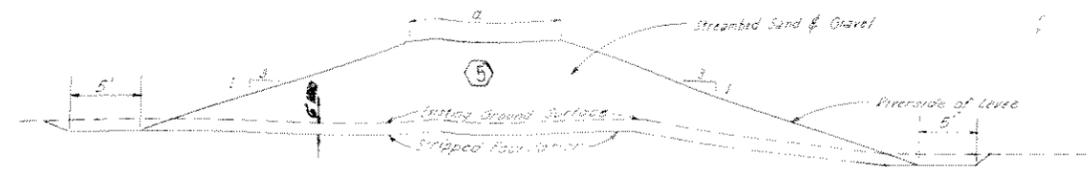
NOTE: For Culvert Details, see sht. 11 for Typical Levee Section, see sheet #7

AS CONSTRUCTED

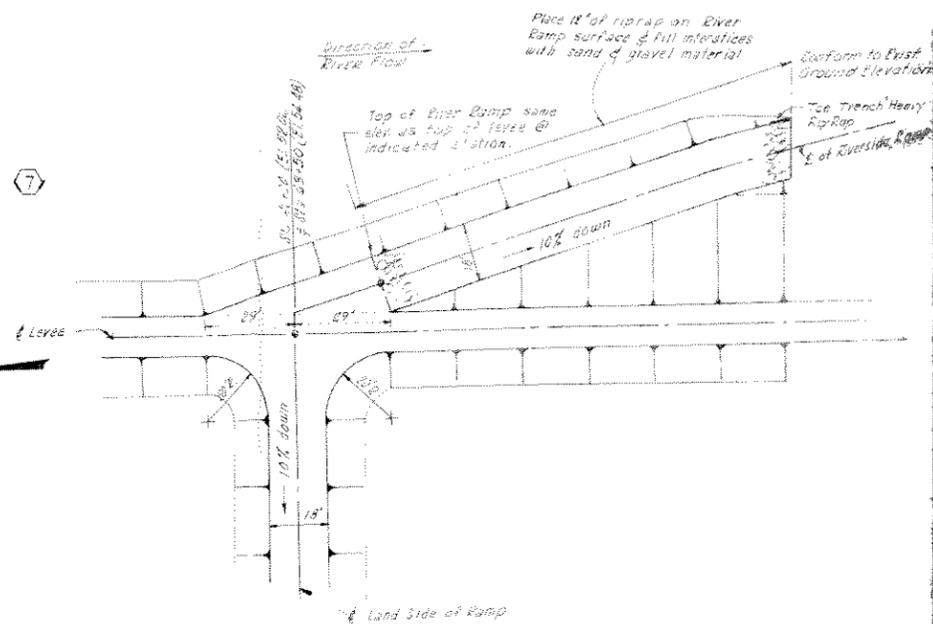
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: W. E.	HUMBOLDT COUNTY CALIFORNIA
TRACED BY:	EEL RIVER FLOOD CONTROL PROJECT
CHECKED BY:	OPERATION AND MAINTENANCE MANUAL
SUBMITTED:	LEVEE EXTENSION AT SANDY PRAIRIE
APPROVAL RECOMMENDED:	PLAN AND PROFILE
	STA. "B" 175+00 TO STA. "B" 189+55.69
DATE: JAN. 1961	
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN JOB NO. DRAWING NUMBER 9 OF 10 60 39 23



PROFILE

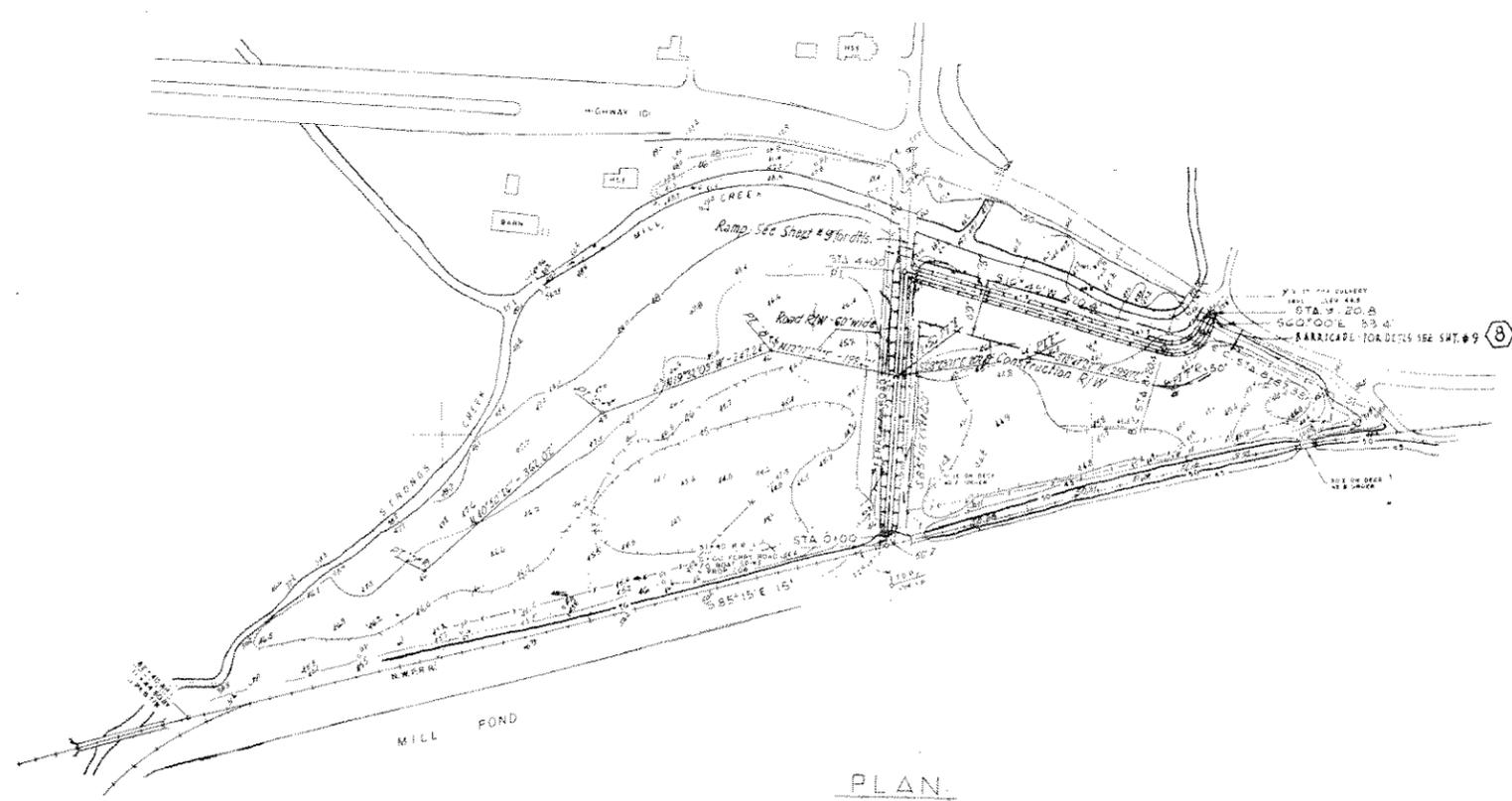


TYPICAL SECTION
 LEVEL "A"
 Sta. 0+00 to Sta. 4+00 2'-0"
 Sta. 4+00 to Sta. 9+208 4'-12"



RAMPS @ STA. 0+42+00
 AND STA. 0+23+50
 SCALE: 1"=40'

NOTES:
 1- For Typical Levee Section, see this sheet.



PLAN
LEVEE "A"



AS CONSTRUCTED

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO CORPS OF ENGINEERS SAN FRANCISCO, CALIFORNIA	
DRAWN BY: J. L. TRACKED BY: CHECKED BY: SUBMITTED: APPROVAL RECOMMENDED:	HUMBOLDT COUNTY CALIFORNIA EEL RIVER FLOOD CONTROL PROJECT OPERATION AND MAINTENANCE MANUAL LEVEE EXTENSION AT SANDY PRAIRIE PLAN AND PROFILE LEVEE "A"
PREPARED UNDER THE DIRECTION OF JOHN A. MORRISON COLONEL, C.E., DISTRICT ENGINEER	SCALE: AS SHOWN SHEET 10 OF 10 DATE: JAN. 1961 JOB NO. 60 39 23

SEMI ANNUAL REPORT
FOR

INSPECTION, MAINTENANCE AND OPERATION

OF

EEL RIVER AT SANDY PRAIRIE FLOOD-CONTROL PROJECT
FORTUNA, CALIFORNIA

Period From: _____ Submitted by: _____

To: _____ Date: _____

INSPECTION LEVEES MAINTENANCE

Feature	Date of Insp.	Location Condition	Date Work Accomplished	Location or Extent	Equipment Used	Time re-quired to Complete	Cost	No. of Personnel
Settlement, sloughing, or loss of grade								
Caving or erosion of levee slopes								
Dislodged or displaced riprap								
Roadway on levee crown								
Access ramps								

Eel River Levees - (Continued)

Feature	Date of Insp.	Location	Condition	Date Work Accomplished	Location or Extent	Equipment Used	Time required to Complete	Cost	No. of Personnel
Unauthorized excavation									
Weeds or undesirable vegetation									
Animal burrows									
Seepage or sand boils									
Sod on levee slopes									
Inappropriate burning									
Unauthorized encroachment on rights-of-way									

Eel River Levees - (Continued)

Feature	Date of Insp.	Location	Condition	Date Work Accomplished	Location or Extent	Equipment Used	Time required to Complete	Cost	No. of Personnel
Debris and silt removal									
Barricades									
Conduits									
Flap gates									
Drainage or toe ditches									

REMARKS: (Include any pertinent information not reported above):

Eel River Levees - Continued

GENERAL

1. What maintenance measures will be required during the next six months?

2. Are these repairs considered beyond the scope of local funds? (If yes, explain)

3. In your opinion, what can be done to improve maintenance and operation of the flood-control project?

a. By your agency:

b. By the United States:

CHECK LIST NO. 1

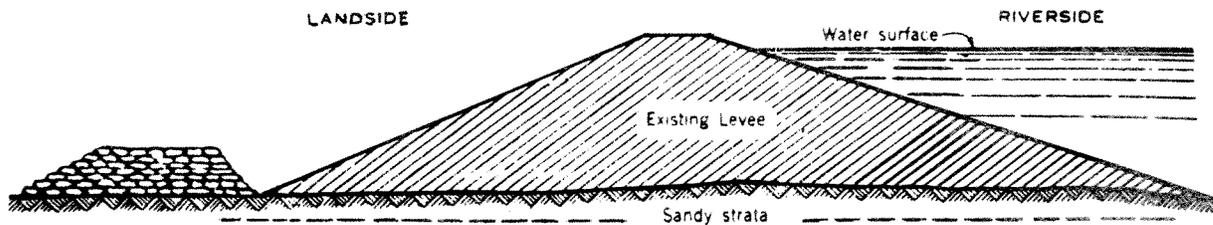
Date: _____

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

EEL RIVER AT SANDY PRAIRIE LEVEES

Item No.	Description	Number of Places
1	Settlement, sloughing or loss of grade	_____
2	Caving on either sides of levee	_____
3	Seepage, saturated levee	_____
4	Drainage or toe ditches at landside and slope	_____
5	Riprap	_____
6	Channel siltation	_____
7	Protective planting (sod)	_____
8	Access roads and ramps	_____
9	Barricades on access roads	_____
10	Levee crown	_____
11	Authorized traffic	_____
12	Unauthorized encroachment on rights-of-way	_____
13	Unauthorized excavation	_____
14	Accumulations of drift, trash or debris	_____
15	Weeds or undesirable vegetation	_____
16	Inappropriate burning	_____
17	Damage by burrowing animals	_____
18	Conduits	_____
19	Flap gates	_____
20	Miscellaneous pipe crossings	_____

EXHIBIT "C"

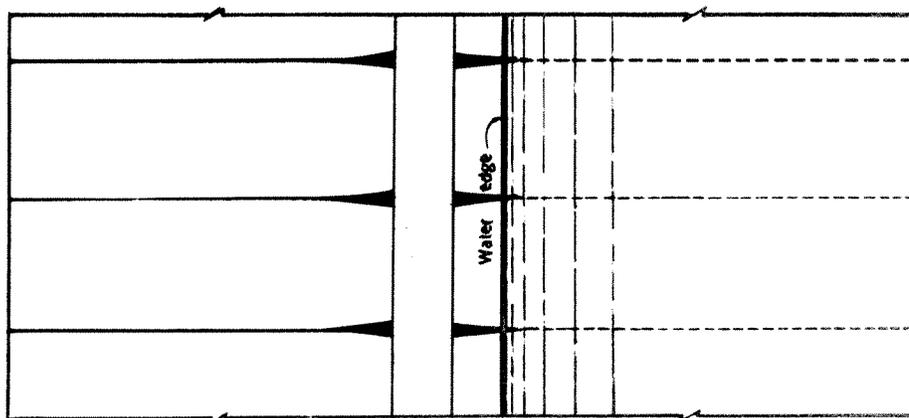
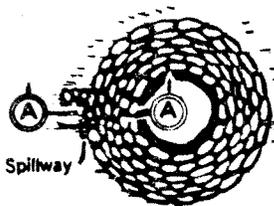


Note:
 Bottom width to be no less than $1\frac{1}{2}$ times height.
 Be sure to clear sand discharge
 Tie into levee if boil is near toe.

ELEVATION



SECTION A-A

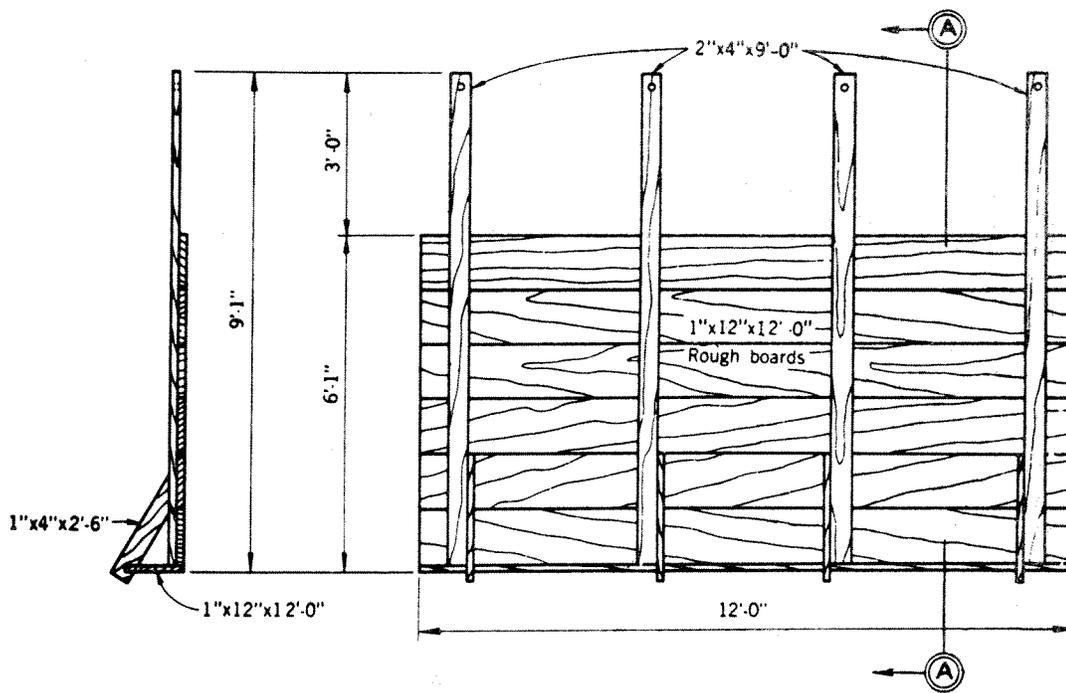


PLAN

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

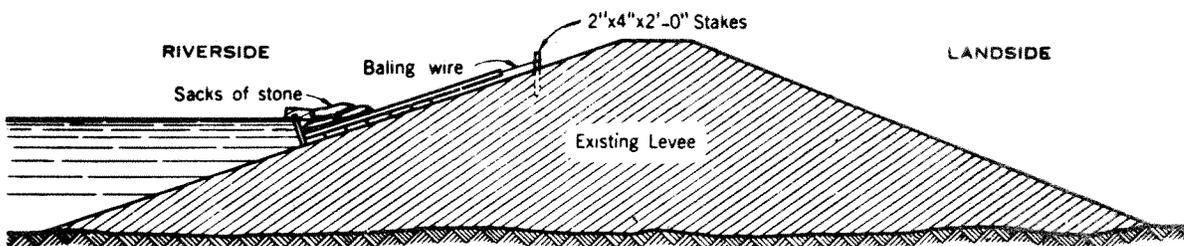
FLOOD EMERGENCY
 CONSTRUCTION
CONTROL OF SAND BOILS

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA



SECTION A-A

PLAN



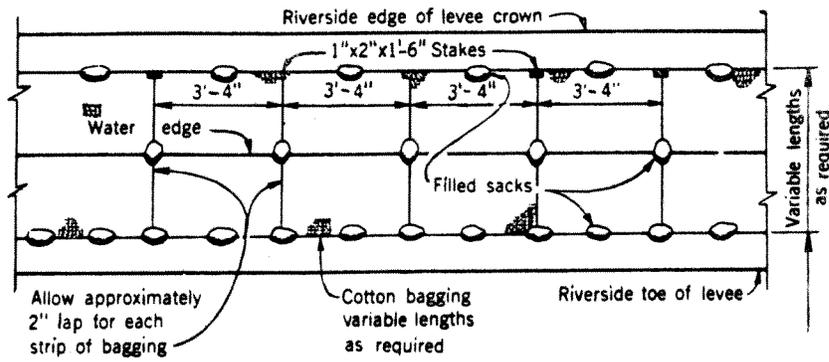
SECTION

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

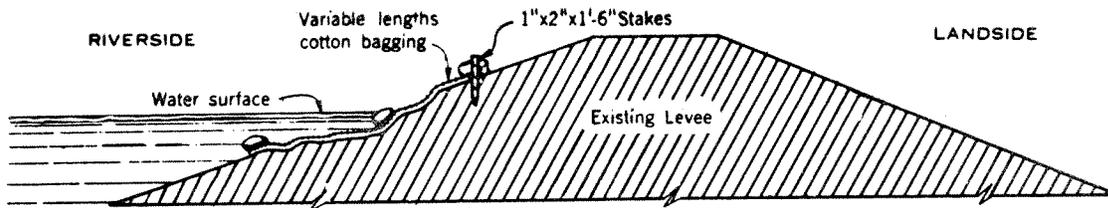
FLOOD EMERGENCY
CONSTRUCTION

**MOVABLE
WAVE WASH PROTECTION**

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA



PLAN

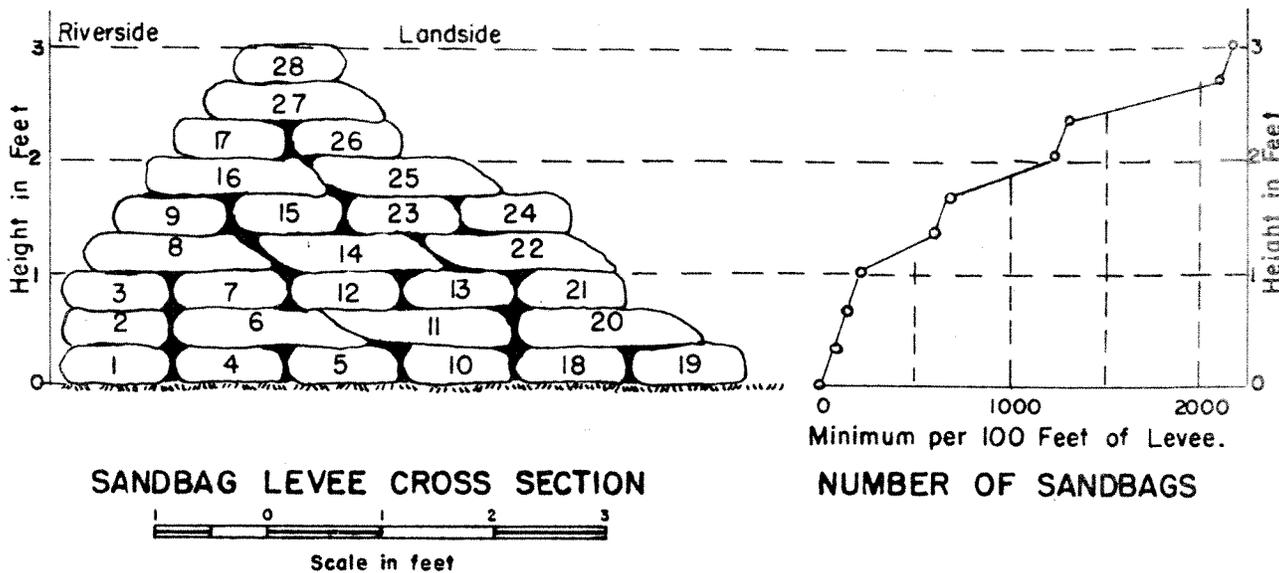


SECTION

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

FLOOD EMERGENCY
 CONSTRUCTION
WAVE WASH PROTECTION
 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA



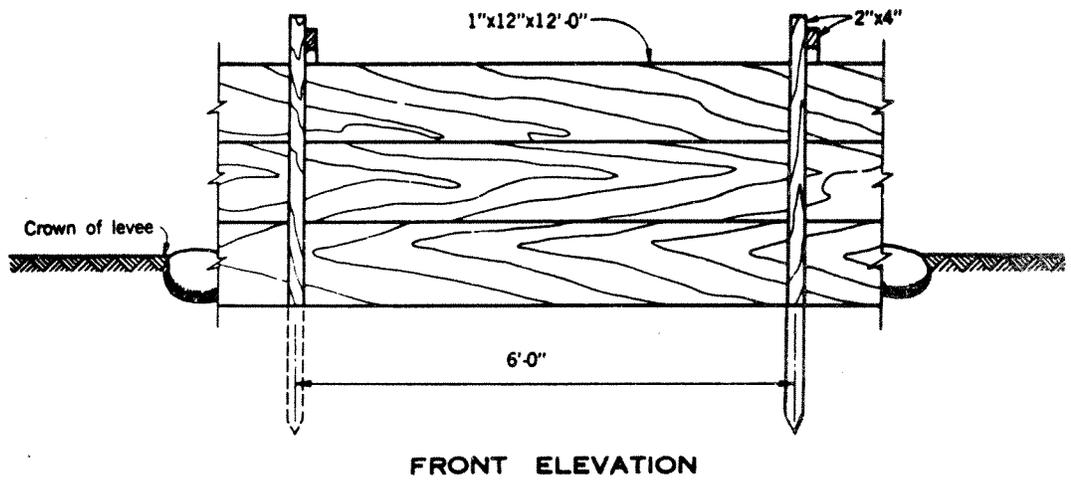
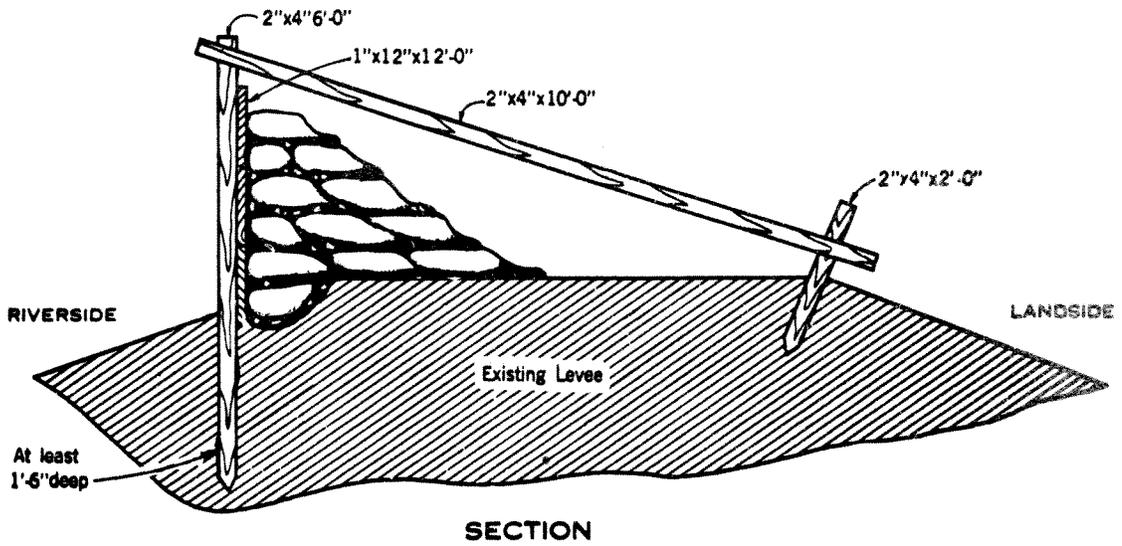
Notes:

1. Entire base to be cleared and scarified.
2. Best material for filling sandbags is a fine sand or coarse silt. Avoid, as much as possible, the use of coarse gravel and heavy clays.
3. Fill sandbags 1/2 to 2/3 full, 50 to 60 pounds, and leave enough flap to turn under. Do not tie.
4. Numbers shown on the sandbags are for the general order of placing the sandbags to give the highest protection with the minimum number of sandbags.
5. When bags are placed, flatten out and fill voids by mashing bags with feet and vigorously tramping each course of the levee section. Provide a levee section as impervious to water as possible. Alternate direction of sacks and stagger joints wherever practical.
6. The above section is based upon an average in place sandbag section of 4" x 12" x 18".

**FLOOD EMERGENCY
 CONSTRUCTION**

SACK TOPPING

 U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
 CORPS OF ENGINEERS
 SAN FRANCISCO, CALIFORNIA



BILL OF MATERIAL FOR 100 LINEAR FEET OF LEVEE	
LUMBER	
25 pieces	1" x 12" x 12'-0"
17 pieces	2" x 4" x 10'-0"
* 17 pieces	2" x 4" x 6'-0"
* 17 pieces	2" x 4" x 2'-0"
* (Sharpened)	
NAILS	
1 lb.	8d nails
2 lbs.	16d nails
SANDBAGS	
1100	bags

FLOOD EMERGENCY
CONSTRUCTION

LUMBER AND SACK TOPPING

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

RESOLUTION NO. 1182

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE
COUNTY OF HUMBOLDT RELATIVE TO FEDERAL AID
CONTROL PROJECT ON EEL RIVER AT SANDY PRAIRIE
AREA

WHEREAS the San Francisco District Engineer, Corps of Engineers, U. S. Army, is undertaking a plan of improvement for flood control on the Eel River at Sandy Prairie area, Fortuna, California; and

WHEREAS the Congress of the United States has enacted a bill which would provide funds for such flood control project, and said bill has been signed into law by the President of the United States; and

WHEREAS a request has been made of this Board of Supervisors that it enact a resolution showing the ability of local interests to meet their commitments of local cooperation, as specified in Project Document (HD 80-85-1), in the form of assurances satisfactory to the Secretary of the Army that they will meet such commitments;

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of the County of Humboldt give, and it does hereby give, assurances to the Secretary of the Army that it will:

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

EXHIBIT "E"

(b) hold and save the United States free from damages due to the construction work;

(c) maintain and operate the project after completion in accordance with regulations prescribed by the Secretary of the Army;

(d) prescribe and enforce regulations for prevention of encroachment on areas required for ponding of interior runoff;

(e) contribute in cash, or equivalent work, 22.3 percent of the total cost of construction, which said 22.3 percent is now estimated to be the sum of \$246,000.00.

BE IT FURTHER RESOLVED that said lands, easements, and rights-of-way will be obtained by October 28, 1958.

BE IT FURTHER RESOLVED that said 22.3 percent of construction cost cash contribution, now estimated at \$246,000.00, will be made on October 28, 1958.

PASSED, APPROVED AND ADOPTED this 30 day of September, 1958, by the following vote, to-wit:

AYES: Supervisors: Lindley, Bareilles, Robertson, Pettersen, Merryman

NOES: Supervisors: None

ABSENT: Supervisors: None

/s/ ELWYN L. LINDLEY
Chairman of the Board of Supervisors
of the County of Humboldt, State of
California

ATTEST:

/s/ FRED J. MOORE, Jr.
County Clerk and Ex-Officio Clerk of
the Board of Supervisors of the
County of Humboldt

EXHIBIT "E"

LEVEE EXTENSION AT SANDY PRAIRIE
NEAR FORTUNA, HUMBOLDT COUNTY, CALIFORNIA

RIGHT OF WAY CERTIFICATION

The COUNTY OF HUMBOLDT hereby certifies in connection with the right of way for Levee Extension at Sandy Prairie near Fortuna, Humboldt County, California, that:

1. All right of way has been acquired or condemnation suit has been filed and order of immediate possession has been taken on those parcels not acquired by negotiation.
2. Agreements to enter and use material from the specified borrow sites have been signed and are in the process of recordation.
3. Several buildings within the right of way are to be removed prior to the start of actual construction and property line fences are to be relocated and rebuilt according to agreement with owners.

In making this certification, the Count of Humboldt agrees to hold the Corps of Engineers, U. S. Army, harmless from any liability which may be established by and in the event the right of way is not clear as herein certified.

Dated: July 8, 1959

COUNTY OF HUMBOLDT

By: /s/ Sam Merryman
Chairman, Board of Supervisors

ATTEST:

/s/ Fred J. Moore, Jr.
Clerk, Board of Supervisors

EXHIBIT "F"