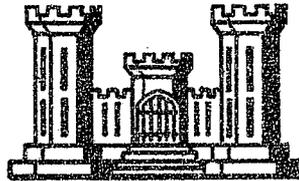


MERCED COUNTY STREAM GROUP

MAINTENANCE MANUAL

OWENS DAM
AND
RESERVOIR



SACRAMENTO DISTRICT

CORPS OF ENGINEERS

U. S. ARMY

SACRAMENTO, CALIFORNIA

FILE COPY

MAINTENANCE MANUAL
OWENS CREEK PROJECT
MERCED COUNTY STREAMS, CALIFORNIA

Prepared in the Sacramento District
Corps of Engineers, U. S. Army
Sacramento, California, dated 1 April 1952

Approved by the Chief of Engineers _____ 195

E. D. File _____

REVISIONS

Date	New pages or exhibits	Date approved by C. of E.

MAINTENANCE MANUAL
OWENS CREEK PROJECT
MERCED COUNTY STREAMS, CALIFORNIA

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MAINTENANCE MANUAL
OWENS CREEK PROJECT
Merced County Streams, California

AUTHORIZATION

1. Authorization. - The Owens Creek project, comprising Owens Dam and Reservoir, was authorized as a unit of the plan of improvement for flood protection on streams in the Merced County Stream Group in San Joaquin Valley, California, by the 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.

PART A

LOCATION AND DESCRIPTION

1. Project location. - Owens Dam and Reservoir is located about 16 miles east from the city of Merced in central California. The project location is shown on Exhibit No. B-1. The dam extends across Owens Creek near the foothill line about 9 miles northeast from the town of Le Grand. Owens Creek rises in the lower Sierra Nevada foothills and flows westerly on the valley floor passing immediately south of the city of Merced to its junction with the San Joaquin River.

2. Project description. - The project works covered by this report include the following:

a. An earthfill dam about 790 feet long with a crest width of 20 feet and a maximum height of 75 feet.

b. An earthfill auxiliary dam with a total crest length of 375 feet, a crest width of 20 feet and a maximum height of 22 feet.

c. An ungated outlet works located near the left abutment of the dam consisting of a reinforced concrete steel lined single barrel conduit having a capacity of 185 c.f.s. at gross pool elevation of 407.5.

d. A spillway located through a ridge at Sta. 19+16 on the project base line consisting essentially of a control weir with a crest length of 75 feet, and an unlined discharge channel 200 feet in length.

3. Protection provided. - The project controls the floodwater run-off from an area of about 26 square miles of foothill and mountain drainage. The entire capacity of 3,600 acre-feet will be available for flood control at all times. The reservoir design flood has a peak flow of 3,400 c.f.s. and a volume of 5,200 acre-feet.

4. Construction history. - The construction was accomplished under two contracts, copies of which are on file in the Office of the District Engineer, Sacramento District, Corps of Engineers, Sacramento, California. Pertinent contract data are as follows:

a. Main Dam, Auxiliary Dam, Outlet Works and Spillway

Contractor	A. Teichert & Son
Contract No.	W-04-167-eng-1678
Work Started	31 March 1949
Work Completed	14 October 1949

b. Abutment Drains and Access Road

Contractor H. Sykes
Contract No. DA-04-167-eng-696
Work Started 25 January 1952
Work Completed (In progress as of this date)

PART B

MAINTENANCE - OWENS DAM & RESERVOIR

1. Purpose and intent of this manual. - The purpose of this manual is to furnish personnel of the District Office with information on the project works and with instructions as to the details of maintenance requirements of the Owens Dam and Appurtenances. The general intent of the contained procedures is to insure that the structures and facilities shall be continuously maintained in such a manner, and operated at such times and for such periods as may be necessary, as to obtain maximum benefits.

2. Definitions. - As used hereinafter the terms "Operation Division" and "Engineering Division" shall refer to organizations within the Sacramento District Office, Corps of Engineers, U. S. Army. "Flood Season" is considered to be the period between 1 November and 30 April. All elevations herein referred to mean sea level datum 1929 adjustment.

3. Duties of the Operations Division. - All inspection, maintenance and operation of the dam and appurtenances, except the stage recorder will be under the jurisdiction of the Operations Division. The general duties of this division shall include the following:

a. Training of key personnel. - Key personnel will be trained in order that regular inspection and 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. They shall become familiar with the provisions of this manual, the construction specifications and "As Constructed" drawings.

b. Inspection and maintenance. - Periodic inspections shall be made by the Chief of the Operations Division or his authorized representative in order to determine maintenance measures required to insure serviceability of the works in time of flood. Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, at intervals not exceeding 90 days, and at such intermediate times as may be necessary. Immediate steps shall be taken to correct dangerous conditions disclosed by such inspections and regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Chief of the Division. All repairs shall be made in accordance with standard engineering practice, to line and grade, and in accordance with details, shown on construction drawings for the project works, copies of which are included in exhibit B-5. The check lists shown on exhibit B-2 shall be used in each inspection to insure that no features of the protective system are overlooked. Items requiring maintenance shall be noted thereon.

c. Files and Records. - The Chief of the Division shall establish a file of all reports and records concerning the project works.

d. Encroachment or trespass on right-of-way. - There shall be no encroachment or trespass which will adversely affect the efficient operation or maintenance of the project. The Chief of the Division shall, therefore, cause notices to be posted at conspicuous places along the project right-of-way directing public attention to this requirement and he shall arrange for the prosecution of offenders and report actions taken to the District Engineer.

e. Permit for right-of-entry or use of portion of right-of-way. All requests for permits for temporary right-of-entry or use of portions of the Government owned rights-of-way shall be carefully reviewed to determine that such use will not adversely affect the safety and functioning of the project structures, or maintenance and flood fighting operations. A sample permit form is attached as exhibit B-3.

f. Reports. - The Chief of the Division shall submit within a 10-day period following 1 July of each year a report to the District Engineer covering inspection, maintenance, and operation of the Owens Dam and Appurtenances which contains a statement of:

- (1) The physical condition of the protective works as summarized from the logs of inspection.
- (2) Flood behavior of the protective works.
- (3) Flood fighting activities during the flood season.
- (4) Prosecutions for encroachment or trespass.
- (5) Permits issued for right-of-entry or use of 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 and operation for the period.

4. Duties of the Engineering Division. - The operation and maintenance of the stage recorder will be under the jurisdiction of the Engineering Division. In addition to maintaining and operating the stage recorder, the Chief of the Division shall maintain a continuous record of stage in the Owens Reservoir, outflow from the reservoir through the conduit, and any flow over the spillway structure. Such records shall

be made available to the Chief of the Operations Division for inclusion in the annual report and for the official files of the project. Exhibit B-6 contains copies of the rating curves for the outlet works and spillway together with an area-capacity curve for the reservoir.

5. Project Works. - The flood control works covered by this manual are known as the Owens Dam and Reservoir Project, and consist of a main dam, an auxiliary dam, an uncontrolled outlet, a spillway, access roads, and miscellaneous facilities. The various items of the project are discussed in more detail in the following paragraphs.

6. Main Dam and Auxiliary Dam.

a. General. - The dam sections consist of compacted impervious fill constructed from homogeneous material borrowed from adjacent areas. The upstream and downstream slopes of the main dam are 2.75 horizontal to 1 vertical. The upstream and downstream slopes of the auxiliary dam are 3 horizontal to 1 vertical. Crown widths of both dams are 20 feet. The crest elevation of both is 422.0. A 12-foot wide gravel surfaced road traverses the full length of the dam crests. The dams are located as shown on sheet 2 of exhibit B-5.

b. Description - Main Dam. - The embankment section starts at station 2+16 and extends easterly 792 feet to station 10+08. The maximum height is 75 feet. The downstream toe is protected from backwater erosion between stations 4+60 and 8+55 by a 1.5 foot blanket of 3-inch⁺ cobbles placed on a 9-inch layer of gravel. The toe protection extends from elevation 371.0 to the valley floor and for a distance of 10 feet downstream.

c. Description - Auxiliary Dam. - The embankment is located between stations 11+15 and 14+90 in a saddle immediately to the left of the main dam and completes the reservoir closure.

d. Inspection and Maintenance - Main Dam and Auxiliary Dam.

- (1) Periodic inspections shall be made by the Chief of the Operations Division or his authorized representative to insure that:
 - (a) No unusual settlement, sloughing or material loss of grade or embankment cross section has taken place.
 - (b) No caving has occurred on either the landside or reservoir side of the embankment which might effect the stability of the section.
 - (c) No seepage, saturated areas, or sand boils are occurring.

- (d) No action is being taken, such as burning grass or weeds during inappropriate seasons, which will retard or destroy the growth of sod.
 - (e) No revetment work, cobble paving or riprap has been displaced, washed out or removed.
 - (f) Embankments are not used for unauthorized grazing or vehicular traffic.
 - (g) 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.
 - (h) Crown of embankment is shaped so as to drain readily and the road surfacing is well graded and maintained.
- (2) To insure the taking of such maintenance measures as will be required for proper functioning of the embankment section, the following items shall be specifically covered in each inspection:
- (a) Settlement, sloughing or material loss of grade or embankment cross section.
 - (b) Erosion of embankment slopes.
 - (c) Presence of seepage, saturated areas, or sand boils on the downstream slopes or at toes of the embankments.
 - (d) Condition of toe protection, abutment drains and riprap.
- (3) Maintenance methods to be used for repair or reconstruction of embankment fill shall depend on the extent of the damaged section. If of small extent, the most suitable method 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. If of larger extent, the fill shall be made in the same manner as the original construction with homogeneous material from borrow pits approved for the project, placed in uniform horizontal layers not more than 6 inches in depth and compacted to a density equal to that of the original embankment section.

- (4) Burrowing animals found in the embankments shall be exterminated. The dens and runways shall be opened up, then thoroughly compacted as they are backfilled. Extermination by trapping and poisoning are usually effective. Advice concerning the best methods of extermination in each locality can be obtained from the county agricultural agent.
- (5) Embankments shall be kept cleared of growths of long grass and brush.
- (6) Gages
 - (a) The automatic recording gage shall be inspected by the Engineering Division at least once in each 30 day period during the flood season (1 November to 30 April). Particular attention shall be given to the following items:
 1. Check that clock is running and rewind if necessary.
 2. Check that pen is marking and refill ink reservoir if necessary.
 3. Check that paper is feeding smoothly through instrument and replace feed roll as necessary.
 4. Check operation of float by turning float wheel back and forth.
 5. Read outside and inside gages and note readings and day and hour of inspection on chart.
 6. Check functioning of inlets to gaging well and clean if necessary.
 7. Check accumulation of silt in gaging well and clean if necessary.
 - (b) The automatic recording gage shall be cleaned, lubricated according to manufacturer's instructions, and overhauled, if necessary, at least once a year, preferably during the month of October, immediately prior to the flood season.
 - (c) Inlet pipes to the gaging well shall be thoroughly flushed clean at least once a year, and as necessary to insure proper functioning of the inlets. Particular attention shall be given to the lowest inlet pipe which is most apt to become clogged.

- (d) Each staff gage shall be cleaned of adhering mud or stain which would interfere with their legibility as often as required.
- (e) At the time of each regular inspection by the Operations Division, the following is to be noted:
 - 1. Damage or settlement of gaging well.
 - 2. Condition of inlets to gaging well.
 - 3. Condition of recorder house.
 - 4. Condition of staff gages - any slippage or displacement.
- (f) Gage house shall be kept in good repair and repainted as necessary. Any adverse conditions disclosed by inspections shall be corrected immediately and all gaging facilities shall be kept in the best possible condition.

e. Flood Emergency Inspection.

- (1) During flood periods, the embankments shall be patrolled continuously to locate possible sand boils or unusual wetness of the downstream slope and to take appropriate corrective measures for the following conditions:
 - (a) Indications of slides or sloughing.
 - (b) Wave wash or scouring action.
 - (c) Other conditions exist which might endanger the structure.
 - (d) Inadequate labor and materials to meet all contingencies. Immediate steps shall be taken to control any condition which endangers the embankments and to repair the damaged section.
- (2) It shall be the duty of the Chief of Operations or his authorized representatives to maintain a continuous patrol of the project works during all periods of flood flow during which the water stage in the reservoir reaches Gross Pool elevation 407.5 or in excess thereof, and to maintain a store of supplies and

equipment available for emergency flood-fighting operations and emergency repairs. In this connection, it is suggested that a copy of the latest revised "Flood Emergency Manual" be consulted for suggested methods of combating flood conditions. Operating personnel assigned to the project shall immediately dispatch a message, by the most rapid means of communication available, to the Chief of the Operations Division whenever the water surface reaches the flood stage indicated above, and also keep him advised at frequent intervals of project conditions until reservoir stage recedes to a safe level.

7. Outlet Structures.

a. General. - The project outlet structures consist of an uncontrolled conduit and a reservoir spillway.

b. Description.

- (1) Conduit. - This structure is located at station 7+90 of the project base line. Details of the outlet structure are shown on sheets 10, 11, and 12 of exhibit B-5. Principal features consist of an unlined approach channel, reinforced concrete intake, conduit through the dam, jump basin and an unlined exit channel. The unlined approach channel extends 375 feet from Owens Creek downstream to the intake section. The channel is trapezoidal in section, with a 10 foot bottom width, 1 on $1\frac{1}{2}$ side slopes, and has a maximum depth of 16 feet. The invert grade is at elevation 347.0. The reinforced concrete intake is a rectangular structure 8 feet wide, 13 feet long and 12 feet high extending from the inlet channel section to the bellmouthed entrance of the conduit. The invert elevation is 347.00. A blanket of grouted 3"+ dredge tailings, averaging 2.0 foot in thickness, extends around the downstream side of the intake structure. A 5.33 ft. x 5.58 ft. concrete structure enclosing a 40 inch I. D. #14 gage corrugated metal pipe extends 428 feet through the embankment from the bellmouthed entrance to the chute into the jump basin. Seepage collars are located at Stations 9+80.00 and 10+20.00 on the conduit line. Contraction joints are located on 32 foot centers throughout the length of the concrete enclosure. The downstream invert elevation is 346.00. The conduit

discharges into a concrete jump basin consisting of a chute 16 feet long and a stilling basin 22.5 feet long by 8 feet wide. The chute varies in width from 3.33 feet at the conduit exit to 8 feet at the stilling basin. The invert elevation at the conduit exit is 346.00. The apron elevation of the stilling basin is 343.00. The stilling basin is provided with baffle blocks and an end sill 2.5 feet high. The guide walls of the jump basin have a top elevation of 352.00. The backfill around the stilling basin walls is protected by a 2 foot thick layer of 3-inch⁺ dredge tailings. An unlined trapezoidal outlet channel 8 feet wide and 240 feet long discharges into the creek bed.

- (2) Reservoir spillway. ~ The spillway is located through the ridge near the left abutment of the dam, at station 19+16 of the dam traverse. This facility includes an approach channel, a concrete spillway control section, and a discharge channel. Details are shown on sheet 15 of exhibit B-5. The unlined trapezoidal approach channel is 75 feet wide with side slopes $1\frac{1}{2}$ on 1. The invert of the approach channel slopes with a 1 percent grade from El. 406.5 at the concrete sill to "daylight" within the reservoir area. The spillway control section consists of a concrete sill 75 feet long set at El. 407.5, gross pool elevation of the reservoir. The exit channel is constructed on a 0.01 slope with a bottom width of 75 feet, side slopes of 1 on $1\frac{1}{2}$, and a length of approximately 190 feet.

c. Inspection and maintenance.

- (1) Adequate measures shall be taken by the Chief of the Operations Division or his authorized representative to insure that the inlet channel, outlet channel, outlet conduit and spillway are sufficiently clear of obstructions and debris to permit proper functioning of the project works. Periodic inspections shall be made to be certain that:
 - (a) Care is being exercised to prevent the accumulation of trash near the inlets and outlets of structures.
 - (b) Erosion is not occurring adjacent to the structures which might endanger water tightness or stability.

- (c) Riprap or gravel blankets adjacent to outlet structures are intact.
 - (d) Approach and discharge channels are sufficiently clear of obstructions, vegetable growth and debris to permit proper functioning of the project works.
- (2) At each inspection required by paragraph 3b of this manual, the following items, if applicable, shall be particularly noted:
- (a) Damage or settlement of concrete intake structure and conduit.
 - (b) Condition of embankment adjacent to outlet structures.
 - (c) Condition of approach and discharge channels.
- (3) All concrete shall be repaired as soon as any reinforcing steel is exposed. The repair shall be made by thoroughly cleaning the surface, by chipping or sand blasting, and building up the concrete to its original section. For this purpose, the use of pneumatically placed Portland cement mortar is considered satisfactory. All evidence of settlement, uplift or failure of concrete structures should be referred to the District Engineer for analysis and recommendation of remedial action.

8. Reservoir. - The reservoir contains approximately 175 acres of pasture land. No unusual items are contained therein at this time which might contribute to the maintenance problem of the project.

9. Access Roads.

a. General. - Owens Dam may be reached by an improved road which leads south-east about 3 miles from State Highway No. 140, approximately at the Mariposa-Merced County line. The turn-off from the State highway is located about 7 miles north-east of the town of Plahada. This route consists of a 16 foot gravel-surfaced roadway with 3 foot shoulders. During periods of heavy rainfall in the foothill area, sections of the road are closed to traffic by inundation.

The dam site may also be reached by means of an improved road leading north-west about $3\frac{1}{4}$ miles from Mariposa Dam. This route consists of an 18 foot gravel-surfaced roadway with 3 foot shoulders.

b. Inspection and maintenance.

- (1) Adequate measures shall be taken by the Chief of the Operations Division or his authorized representative to properly maintain the access roads so that flood emergency operations will not be delayed or obstructed. Immediate steps will be taken to repair damage or remedy adverse conditions disclosed by inspections. Periodic inspections shall be made to be certain that:
 - (a) Roadway surfaces are reasonably well graded and in condition to sustain emergency travel. Surfaces shall be firm, smooth, stable, and free from large rocks or cobbles. Ruts, low areas or spots where gravel surfacing has been displaced shall be filled to original grade with clean, well-graded gravel or crushed rock.
 - (b) Travel will not be impeded by sloughing or slides.
 - (c) Shoulders have not been so badly eroded that the full width of the roadway is impaired.
 - (d) Culverts are clear and free-flowing and that erosion of the shoulders adjacent to culverts has not occurred.
 - (e) Safety fences at cattle guards, and cattle guards are in good condition, and reflectors are in place and unbroken.
 - (f) Fence connections to cattle guards are taut and that barbed wire strands are not broken.
 - (g) Gates are in good operating condition, free swinging and locked.
- (2) At least once a year, or as required for protection and serviceability, all painted safety fence posts and rails, and cattle-guard metalwork shall be repainted. Painted surfaces shall be thoroughly cleaned before applying paint. All paint shall be brush applied.
- (3) Gates. - Damaged or broken tubular steel gates, posts, or braces shall immediately be repaired. Missing fastening chains and locks shall immediately be replaced. Keys to locks shall be kept readily available at the area office to permit ready passage through the gates for all authorized travel.



EXHIBIT B-2

CHECK LIST NO. 1

Embankments, Main Dam and Auxiliary Dam

Inspector's Report Sheet No. _____ Date _____

<u>Item</u>	<u>Remarks</u>
(a) Location by station.	
(b) Settlement, sloughing or loss of grade	
(c) Condition of weed or brush growth on slopes.	
(d) Condition of roadways including ramps.	
(e) Evidence of seepage.	
(f) Condition of upstream and downstream toes, and abutment drains.	
(g) Corrective action taken since last inspection.	
(h) Comments.	

Check List No. 1 (Cont'd)

Instructions for completing Check List No. 1, Exhibit B-2

- (a) Show station of observation obtained by pacing from nearest referenced point. (Except as otherwise noted below.)
- (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 gulying of the section has occurred.
- (c) Note condition of weed and brush growth, and if there has been burning of same and evidence of unauthorized grazing.
- (d) Note any material change in grade and section of roadway. Indicate any inadequacy in surface drainage system.
- (e) Indicate any evidence of seepage through the embankment.
- (f) Indicate any evidence of gulying parallel with toes of dislocation of cobble paving or dredge tailings.

EXHIBIT B-2

CHECK LIST NO. 2

Outlet Works and Gaging Facilities

Inspector's Report Sheet No. _____ Date _____

<u>Item</u>	<u>Remarks</u>
(a) Name of structure and location.	
(b) Debris or obstructions to flow.	
(c) Damage or settlement of conduit or structure.	
(d) Condition of concrete.	
(e) Condition of unlined approach and discharge channels.	
(f) Condition of grouted and un-grouted dredge tailings protection.	
(g) Condition of staff and recording gaging facilities.	
(h) Corrective action taken since last inspection.	
(i) Comments.	

Check List No. 2 (Cont'd)

Instructions for completing Check List No. 2, Exhibit B-2

- (a) Indicate type of structure and enter centerline station. (This sheet is intended for use during inspections of the uncontrolled outlet works, the spillway and gages.)
- (b) Inspect the conduit and the intake and outlet channel sections for accumulations of sediment, rubbish and vegetal matter, and note any adverse condition found.
- (c) Record any settlement of the conduit or of the spillway sill.
- (d) Indicate condition of concrete and record evidence of cracks, "pop-outs", spalls and abrasive wear.
- (e) Note condition of approach and discharge channels and indicate any changes in grade or alignment caused by either deposition or scouring action and presence of any debris or drift that might damage or clog the outlet works.
- (f) Note condition of dredge tailings blanket protection and indicate such changes as disintegration of rock or grout, erosion or movement and the presence of vegetal growth through the blanket.
- (g) Note the condition of recording gage facilities in respect to: Serviceability of inlet pipes and strainers to the stilling well; any settlement of concrete base; all bolted connections; functioning of automatic recorder and float system and accumulation of silt in the stilling well.

EXHIBIT B-2

CHECK LIST NO. 3

Access Roads

Inspector's Report Sheet No. _____ Date _____

<u>Item</u>	<u>Remarks</u>
(a) Location.	
(b) Roadway surface.	
(c) Sloughing or slides.	
(d) Shoulders.	
(e) Condition of culverts.	
(f) Cattle guards and safety fences.	
(g) Gates.	
(h) Corrective action taken since last inspection.	
(i) Comments.	

Check List No. 3 (Cont'd)

Instructions for completing Check List No. 3, Exhibit B-2

- (a) Show point of observation obtained by noting mileage east or west, respectively, from State Highway No. 140, Owens or Mariposa Dam.
- (b) Note conditions of surfacing and required re-surfacing.
- (c) Estimate volume of material to be removed.
- (d) Estimate volume of material required to recondition shoulders.
- (e) Note condition of vegetative growth.
- (f) Note condition of intake and discharge. Indicate any inadequacy of drainage facilities.
- (g) Note condition of cattle guards and safety fences. Report reflectors requiring replacing. Indicate damage to posts, rails and metalwork, or broken wire strands.
- (h) Note condition and any damage to gate posts, braces and gate panels. Note if fastening chains and locks are in place.

EXHIBIT B-3

PERMIT

(Name of Levee Commission or City)

(Location)

Permission is hereby granted to:

(Name of Firm or Individual)

(Address)

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

Provided That:

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

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

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

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

Signature (Grantee)

(Date)

(Date)

District Engineer

EXHIBIT B-4
INDEX OF DRAWINGS
OWENS CREEK PROJECT - DRAWING NO. ME-2-112-45
AS CONSTRUCTED DRAWINGS

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ACCESS ROADS

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ME-2-117-47	Access Road from Owens Dam to Mariposa Dam Plan and Profile	1 to 7
ME-2-117-1	Owens Dam Access Road Details of Cattle Guard	1 of 1

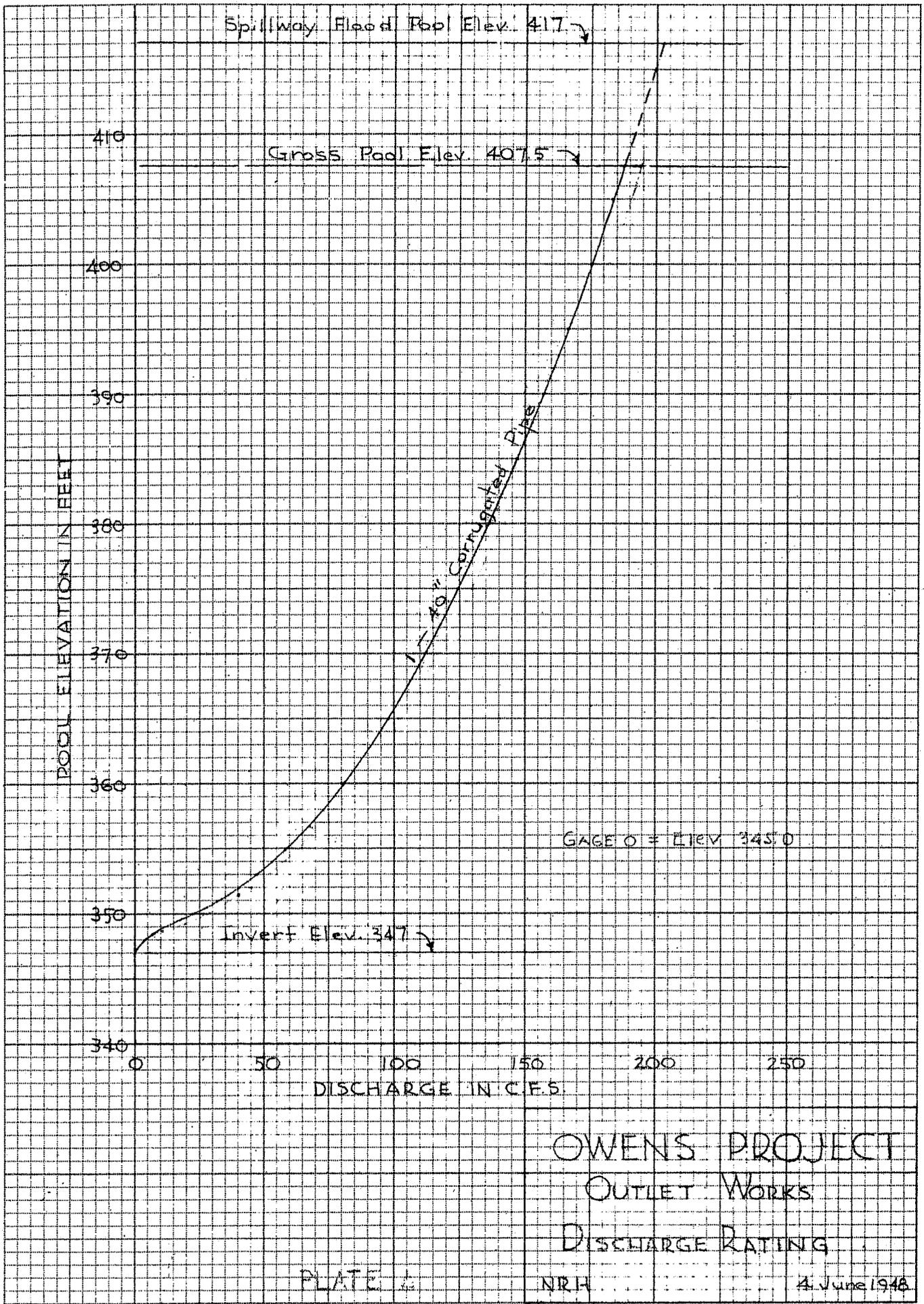
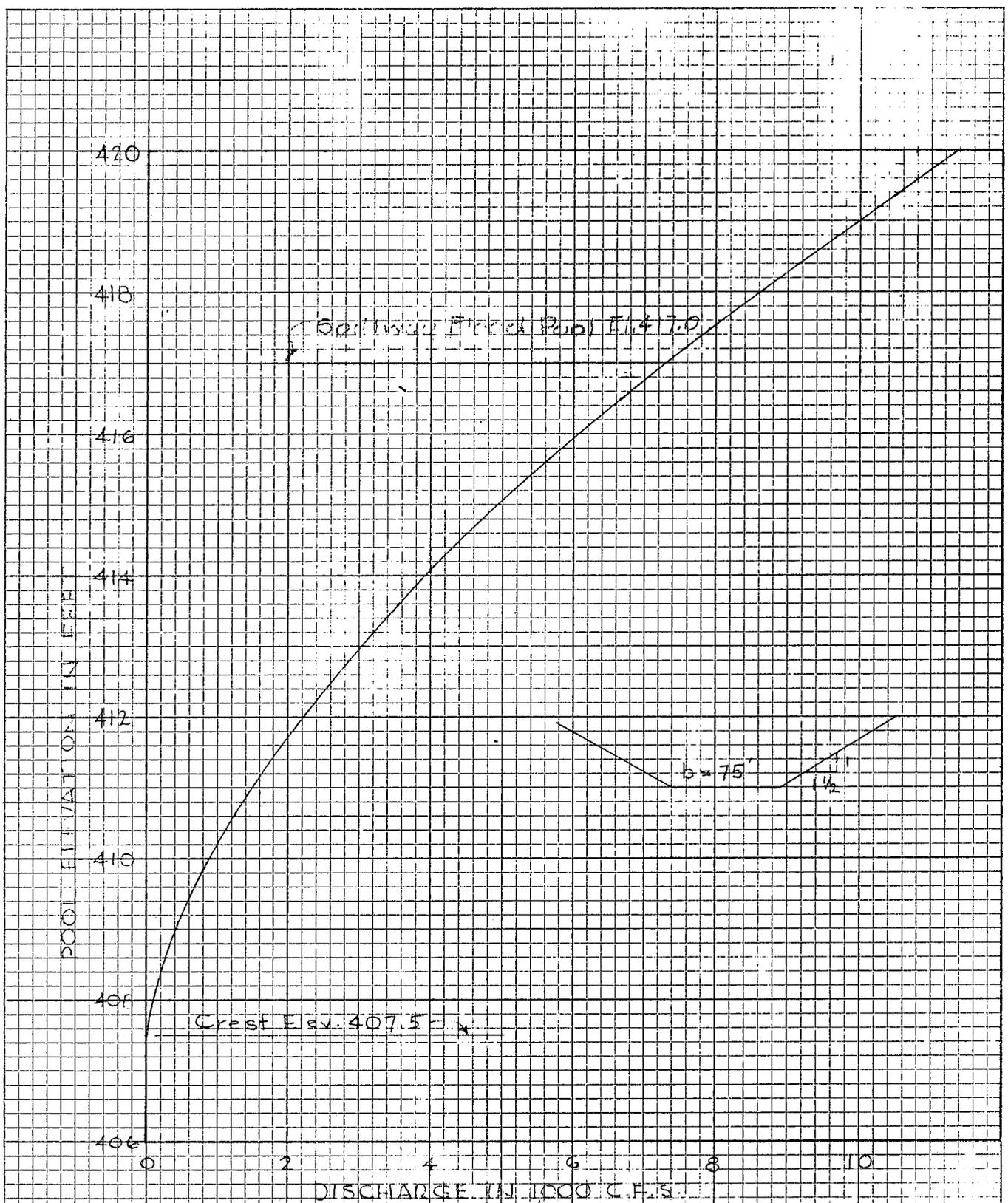


EXHIBIT B-6-1

10 X 10 PER INCH
NO. 2407-10-RIETZEN GRAPH PAPER
EUGENE DIETZEN CO.
MADE IN U.S.A.

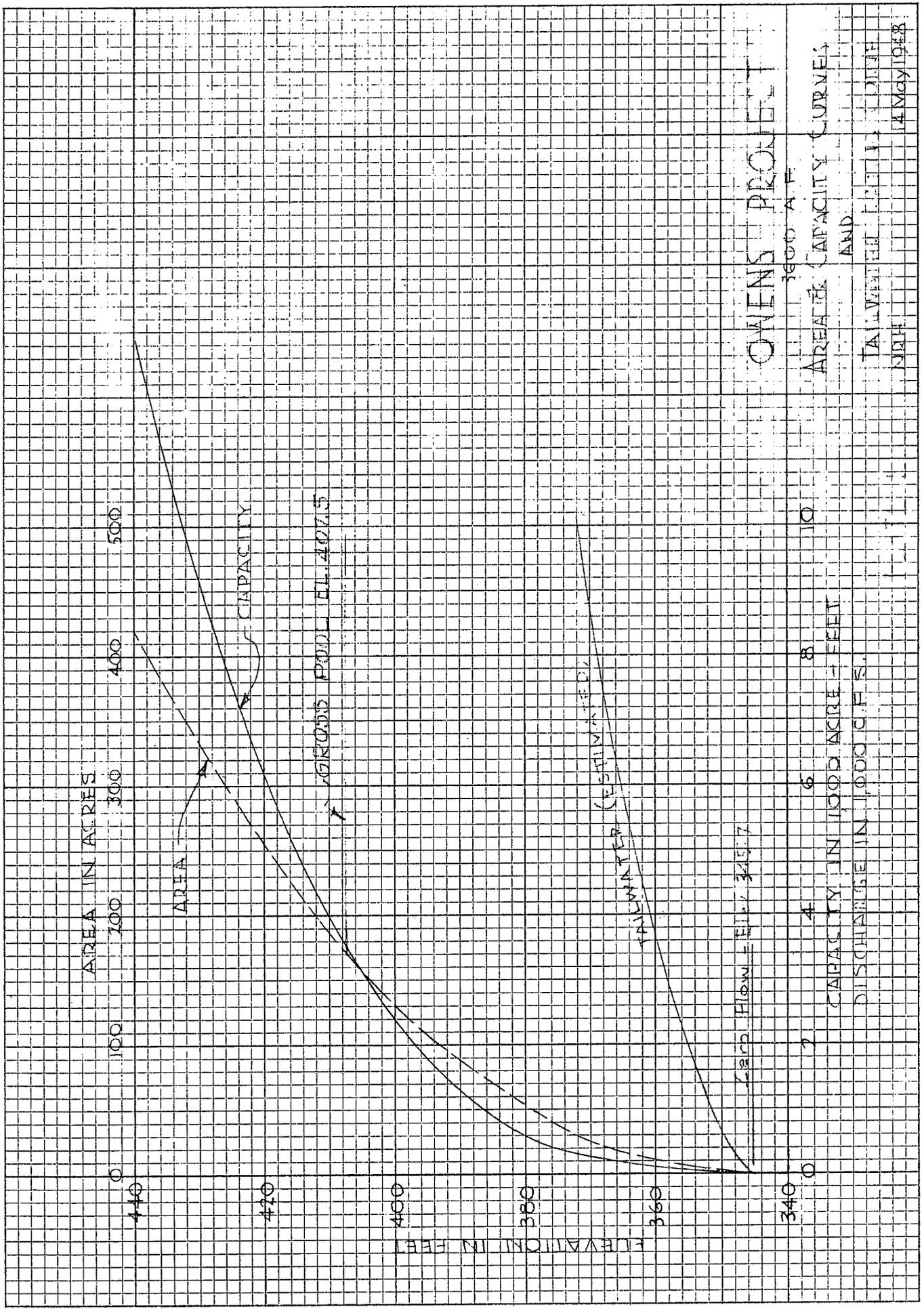


OWENS PROJECT
BLOOD A.F.

SPILLWAY RATING CURVE

NRH
14 May 1948

EXHIBIT B-5-2



OWENS PROJECT
 3600 A.F.
 AREA & CAPACITY CURVES
 AND
 ESTIMATED RAINWATER
 CAPACITY