
OPERATION AND MAINTENANCE MANUAL

MIDDLE CREEK - PART NO. 1
PUMPING PLANT

MIDDLE CREEK PROJECT, CALIFORNIA



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

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U. S. Army Engineer District, Sacramento
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EXHIBITS

<u>Exhibit</u>	<u>Description</u>	<u>Pages</u>
A	Federal Flood Control Regulations	1 and 2
A-1	Location Map	1 sheet
B	"As Constructed" Drawings	Unattached
C	Manufacturer's Data	Unattached
D	Photographs	1 thru 7
E	Letter of Acceptance by the State Reclamation Board	1 sheet
F	Inspection Check List	1 thru 8
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SECTION I

INTRODUCTION

1-01. Authorization. The Middle Creek Project was authorized by the Flood Control Act of 1954, approved 3 September 1954, Section 203 of which reads in part as follows:

"Sacramento River Basin the project of flood protection for Middle Creek, California is hereby authorized in accordance with the recommendations of the Chief of Engineers in House Document Number 367, Eighty-first Congress....."

Authorizing legislation by the State of California is contained in Section 12656.5 of the State Water Code and was enacted under the California Statutes of 1955.

1-02. Location. The Pumping Plant is a part of the Middle Creek Project, which consists of about a total of 14.5 miles of levees along Middle, Scott, Clover, Alley and Poge Creeks in the vicinity of the town of Upper Lake, Lake County, California. The pumping plant lies about 1-1/2 miles south of the town of Upper Lake and about 1/2 mile southwesterly from a small hill known as Bloody Island.

1-03. Project Description. The project levee at the pumping plant intercepts drainage from a 3.1 square mile area of relatively flat valley floor lying east of Middle Creek between Clover Creek and Bloody Island. Drainage from this area is collected in a series of channels which combine into a single large channel before reaching Middle Creek. The pumping plant consists of three drainage pumps with an average capacity of 130 cubic feet per second and a sump with an active storage capacity of 185 acre-feet. Facilities are provided for reverse gravity flow from Middle Creek to the sump when inflow of drainage water is insufficient to provide the irrigation water required for valley floor lands behind the project levees. For more detailed description of the pumping plant facilities see paragraph 5-01 of this manual.

1-04. Construction Data. Construction of the Pumping Plant for Interior Drainage on the Middle Creek Project was accomplished under Contract No. DA-04-167-CIVENG-58-73 by the M & K Corporation during the period from 23 July 1958 to 13 March 1959.

SECTION II

LOCAL COOPERATION REQUIREMENTS

2-01. Requirements of Local Cooperation. House Document No. 649, Seventy-eighth Congress, Second Session, requires local interests to (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the levees and channel improvements; (b) hold and save the United States free from damages due to construction of levees and channel improvements; and (c) maintain and operate all levees and channel improvements after completion in accordance with regulations prescribed by the Secretary of the Army. The State of California by legislation amended in 1955 has agreed to furnish the required cooperation.

2-02. Assurances Provided by Local Interests. The State of California by legislation enacted in 1955 has agreed to furnish the required cooperation. Section 13657 of the State Water Code states:

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

2-03. Acceptance by the State Reclamation Board. Responsibility for operating and maintaining the completed works was officially accepted by the Reclamation Board of the State of California by letter dated 26 September 1960, as shown on the attached letter of acceptance, EXHIBIT E.

SECTION III

MAINTENANCE AND OPERATION - GENERAL PROCEDURE

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

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

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

3-03. Purpose of this Manual. In view of the large number of local flood protection projects authorized by Congress and the repetitious nature of regulations to govern maintenance and operation of each individual project, and in order that local interests may be fully aware of the extent of the obligations assumed by them in furnishing assurances of local cooperation for projects to be constructed in the future, the general regulations described above were established by the Secretary of the Army. The general regulations approved by the Secretary of the Army, August 1944, were intended to be sufficiently broad in scope and general in nature as to be applicable to all flood-protect-projects for which such regulations are required by law. Section 208.10(a)(10) of the regulations read as follows:

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

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

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

- "(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of, or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of an organization responsible for the efficient operation and maintenance of all structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.
- (3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.
- (4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way of the protective facilities.

- (5) No improvement shall be passed over, under or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any features of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer, or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the works.
 - (6) It shall be the duty of the Superintendent* to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.
 - (7) The District Engineer or his authorized representative shall have access at all times to all portions of the protective works.
 - (8) Maintenance measures or repairs which the District Engineer deems necessary, shall be promptly taken or made.
 - (9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."
- *In this case the "Superintendent" will be the State Department of Water Resources.

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

- a. Furnish to local interests "As Constructed" drawings of the project works at the time they are transferred.
- b. Make periodic inspections of the project works and notify local interests of any repairs or maintenance measures which the District Engineer deems necessary in addition to the measures taken by local interests.

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

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

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

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

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

- (1) An assistant to act in the place of the Superintendent in case of his absence or indisposition.
- (2) Sector foremen in sufficient number to lead maintenance patrol work of the levee, inspect the channel, and operate the gate structures properly during flood periods. High qualities of leadership and responsibility are necessary for these positions.

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

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

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

(1) That all work shall be performed:

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

(b) To the satisfaction of the District Engineer.

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

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

f. Inspection.

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

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

- (2) The suggested check lists and instructions shown in Exhibit F, Sheets 1 to 8, inclusive, are to be followed in each inspection to insure that no features of the protective system are overlooked. Carbon copy of the inspector's original field notes as recorded on the check list shall be transmitted to the District Engineer immediately following each inspection, and one copy included as an inclosure to the semi-annual report as provided in paragraph 3-07(h)(1) of this manual.

g. Maintenance.

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

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

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

h. Reports.

- (1) Semi-Annual Report. In accordance with the provisions of the Flood Control Regulations, paragraph 208.10(a)(6), the Superintendent shall submit within a 10-day period following 1 December and 1 June of each year, a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works. This report will present a statement of:
 - (a) The physical conditions of the protective works as summarized from the logs of inspection.
 - (b) Flood behavior of the protective works, and flood-fighting activities during the period.
 - (c) Prosecutions for encroachment or trespass.
 - (d) Permits issued for right-of-way or use of right-of-way.
 - (e) Permits issued for improvements or construction within the project right-of-way.
 - (f) Maintenance measures taken; nature, date of construction, and date of removal of temporary repairs; date of permanent repairs.
 - (g) Fiscal statement of cost and maintenance and operation for the period.

3-08. Inspection Procedure. Since the enactment of State Legislation of Chapter 1528, Statutes of 1947, the Department of Water Resources, State of California, has made semi-annual inspections of all levees of authorized flood control projects in the Sacramento-San Joaquin drainage basin pursuant to the Federal Regulations of 16 August 1944 (Title 33), and reports its findings to the local agency, the State Reclamation Board and the Sacramento District, Corps of Engineers, U. S. Army. This activity, initiated pursuant to Section 208.10(a) of the Federal Regulations, has in effect provided for transfer from the local agencies to the State Department of Water Resources the obligation of compliance with Sections 8371, 8372, and 8373 of the Water Code of the State of California. These sections of the Code require the local responsible agencies to submit a report to the State Department of Water Resources on or before 1 June of each year on the condition of the levees and channels within their jurisdiction. Supervisory powers and duties of the Department are applicable to all works of the authorized projects maintained and operated by the local agencies without regard to status of completion, or expenditure of Federal funds on the construction of such works.

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

SECTION IV

FEATURES OF THE PROJECT SUBJECT TO FLOOD CONTROL REGULATIONS

4-01. Levees. The levee adjoining the Pumping Plant is subject to the Flood Control Regulations which will be more fully outlined in the Operation and Maintenance Manual, entitled, "Levee Construction and Channel Improvement - Part No. 2 - Middle Creek Project".

4-02. Structures. The pumping plant, sump and outlet structure is subject to the same Flood Control Regulations as the levees and channels, therefore, the operation, maintenance and inspection of these features shall be coordinated with that of the levees and channels.

4-03. Pumping Plant.

a. Description. The pumping plant is as described in paragraph 5-01 of this manual.

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

"(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 season 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 shall be kept on hand at all times. 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. Only skilled electricians and mechanics shall be employed on tests and repairs. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable."

c. Operation. Pertinent Requirements of the Code of Federal Regulations, paragraph 208.10(f)(2) are quoted in part as follows:

"(f)(2) Operation. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall be familiar with the equipment manufacturer's instructions and drawings and with the "Operating Instructions" for each station. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house 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."

SECTION V

MECHANICAL AND ELECTRICAL FEATURES

5-01. Description.

a. General. The pumping and flow control facilities consists principally of three pumps, a by-pass system with required controls, and appurtenances. Runoff from the drainage area flows through a channel to the pump sump at the pumping plant; the entrance to the sump being protected by a steel trash rack. The bottom of the pump sump is at elevation 1312.75. Three drainage pumps are provided for controlling the water level in the collecting sump and are automatically controlled by float switches. Each pump discharges into a distribution box located adjacent to the pump sump. A 30-inch flap gate is provided at the end of the respective discharge pipes to prevent any possibility of back flow from the distribution box to the pump sump. From the distribution box the water flows by gravity via two 42-inch drain pipe lines through the levee to the river. Bottom of the distribution box is at elevation 1314.00 and the invert elevations of the drain pipes are at elevations 1314.65 and 1320.15 respectively. A manually operated slide gate is provided in each of the above mentioned 42-inch drain pipes, to provide a positive shut-off when desired and is located on the river side just beyond the crest of the levee. In addition to the above a 42-inch by-pass is provided around the pump sump between the drainage collection area and the distribution box. This by-pass permits taking advantage of possible gravity flow from the drainage area during period of high water and controls flow in the reversed direction, from the river, for irrigation during the summer months. The distribution box end of the 42-inch by-pass is equipped with a manually operated combination flap gate and slide gate. The flap gate prevents possible back flow from the distribution box to the drainage area during gravity flow control; the opposite end is provided with a manually operated slide gate.

b. Drainage Pumps.

- (1) Type. Each sump pump is vertical, open impeller, submerged type, directly connected to a vertical electric motor. Pumps are designed to permit ready withdrawal of the entire pump, including discharge column elbow, housing and suction bell, through the opening in the floor at the motor.
- (2) Capacity. The pumps are capable of discharging the required design capacities listed in lines 4, 6, and 11 of the following table at total dynamic heads corresponding to the static head listed in lines 3, 5, and 10 respectively. They are capable of operating at total dynamic heads corresponding to static heads between those listed in

lines 1 and 5 without exceeding the motor horsepower listed in line 12, and between those listed in lines 5 and 7 without exceeding the motor horsepower listed in line 12 by more than the motor service factor of 1.15. At static heads listed in line 8 the pumps are capable of starting and reaching full speed without exceeding the motor horsepower listed in line 12 by more than the motor service factor of 1.15. At static heads listed in line 9 the pumps shall be capable of starting and reaching full speed without exceeding the horsepower listed in line 12 by more than the motor overload factor of 1.25.

(3) Table No. 1.

(1) Minimum Operating Static Head	0(e)
(2) Sump Elev. at Min. Oper. Static Head	1322.0
(3) Min. Design Static Head	2.5(d)
(4) Capacity at Min. Design Static Hd. (G.P.M.)	22,000
(5) Maximum Design Static Head	13.0(a)
(6) Capacity at Max. Design Static Hd. (G.P.M.)	19,000
(7) Max. Operating Static Head	16.0(b)
(8) Design Starting Static Head	13.0(a)
(9) Max. Starting Static Head	15.0(c)
(10) Rated Design Static Head	13.0(a)
(11) Capacity at Rated Design Static Hd. (G.P.M.)	19,000
(12) Max. Motor Horse Power	100

Note (a) Water surface in sump at elev. 1320 and water surface in Middle Creek at elev. 1333.

Note (b) Water surface in sump at elev. 1320 and water surface in Middle Creek at elev. 1336.

Note (c) Water surface in sump at elev. 1320 and water surface in Middle Creek at elev. 1335.

Note (d) Water surface in sump at elev. 1326 and water surface in Middle Creek at elev. 1328.5.

Note (e) Water surface in sump and Middle Creek at same elevation.

- (4) Efficiency. The efficiency of pumps is specified to be such that nominal rating of the motor required will not exceed that listed in line 12 of table in subparagraph (3) above. Also that efficiency at or below total dynamic head corresponding to maximum design static head shall be not less than 95 percent of peak efficiency.

- (5) Specific Speed. The specific speed of each pumping unit at all stages of water sump and river levels are specified not to exceed the value computed in accordance with Figure No. BFl6, Tenth Edition of the Hydraulic Institute.
- (6) Total Dynamic Head. The total dynamic head consists of the static head (difference between water surfaces in sump and in Middle Creek) plus the losses through the system. The losses through the system do not include losses in the pump itself and in the discharge column. The required capacity of each pump under actual operating conditions is shown, together with the static heads and corresponding total dynamic heads under the design conditions in the following tabulation. Capacity at minimum design head shall not exceed amount stated by more than 5%.

<u>Condition</u>	<u>Static Head (feet)</u>	<u>Total Dynamic Head (feet)</u>	<u>Required Capacity (G.P.M.)</u>
Min. Design Hd.	2.5	7.2	22,000
Max. Design Hd.	13.0	16.5	19,000

c. Float Operated Controllers.

- (1) General. The float controls are provided for automatic operation of the pumps in accordance with the prescribed operating procedure. A float control assembly consists essentially of a separate float well and float control device operating off the water level in the sump. Two float control assemblies are provided, one for the pump sump and one for the distribution box.
- (2) Drainage Sump Float Controls. The sump float control consists of a ten-inch float well and a float control device designed for automatic control of all three pumps. The float control device is a type M-3 "Selectrol" as manufactured by the Automatic Control Company of St. Paul, Minnesota. The switch mechanism consists of a separate enclosed mercury contactor for each of three circuits which open and close in any desired combination by means of discs revolving on a stainless steel drive shaft. Each disc has a removable telescoping cam segments. The shaft is driven through gears by a ceramic float, approximately 8-inch in diameter, suspended by a stainless steel tape from a cast aluminum sheave. An adjustable clutch is provided to allow any desired drawdown for all circuits except one which is handled separately by an adjustable compensating device to allow a greater operating range for the one pump. Each

circuit is provided with a manual transfer plug. The total float travel under normal operation will be six feet. The sump float control operates to start the pumps on a rising sump level at the respective elevations designated as "LOW-WATER STARTS," in the table below, except when the discharge chamber float control is in the "OFF" position. The pump sump control devices starts the respective pumps at the elevations designated in the table as "HIGH-WATER STARTS," and stops the respective pumps on a falling sump water level at the elevations shown in the table regardless of the position of the discharge chamber float control.

Table No. 2

<u>Action</u>	<u>Elevation for Action Indicated</u>		
	<u>Pump #1</u>	<u>Pump #2</u>	<u>Pump #3</u>
Low-Water Start	1319.9	1320.2	1320.2
High-Water Start	1322.5	1323.0	1323.0
Stop	1319.5	1319.8	1319.8

- (3) Distribution Box Float Control. The float control assembly for the distribution box is a type SB-1 "Floatrol," as manufactured by the Automatic Control Co., St. Paul, Minnesota. It is equipped with a 4-1/2 inch diameter ceramic float suspended by a stainless steel tape from a cast aluminum sheave appropriately counter weighted. The sheave drives through gears, a stainless steel drive shaft on which are mounted cams, which by means of a weighted throw-over-center mechanism, to open or close snap-action mercury switches to control the circuit. The float travel is approximately 17 feet. This device overrides the sump float control at the "LOW-WATER STARTS" or the "STOPS". The discharge chamber float control device to be set so as to operate at the following water levels in the discharge chamber:

Elevation 1322, rising	ON
Elevation 1321.5, falling	OFF

5-02. Inspection.

a. General. Periodic inspections are required to detect incipient faults before serious damage takes place, therefore, the importance of making these inspections cannot be over-emphasized. The frequency and extent of inspection required in a measure will be influenced by the conditions under which the equipment is required to operate including whether or not the

particular operation is relatively continuous or periodic for the period concerned. Once each year the entire mechanical and electrical installation should be given a thorough detailed inspection. The regular more frequent inspections are made to make certain that all parts of the equipment including controls are in operable condition and properly lubricated; that no parts are missing; that all painted surfaces are covered with adequate coats of protective paints; that there is no evidence of rust; and that the entire plant is in a clean and presentable condition. In order that no items of inspection will be overlooked, an inspection schedule listing all items requiring inspection shall be carried during the inspection as guide, check list and record. Exhibits "F", "G", and "H" of this manual will serve as a guide and check list for conducting the inspections and preparation of reports. For records required to be maintained and reports to be made see Exhibit "A" and paragraph 5-04 of this manual.

b. Drainage Pump - Motor Units.

(1) Pumps.

- (a) During periods of pumping operations, daily inspections should be made to ascertain that there is sufficient lubricant for the pump bearings and that the pump and motor are operating smoothly, and that there is no abnormal vibration of the assembly. The operator should be instructed to immediately shut off the pump, should an unusual noise or vibration develop, rather than wait to consult with someone else, inasmuch as by prompt action at the instance trouble first develops, serious damage to the pump may be prevented. Noise, vibration, etc., may be due to a worn or damaged bearing, loose anchors, obstruction in pump such as rocks, wood, etc., or other possible causes. (See sheet 7 of Exhibit D).
- (b) When initially starting the pump first insure that it is properly lubricated with oil, that the lubricant has had time to reach the bearings, also insure that there is ample water in the pumping pit. Insure that the oil reservoir is full and that there are no leaks in the lubrication system. Check the flow inspection indicator where provided to insure that the oil is flowing to the bearings as required. For the initial start and run 30 drops per minute should be supplied. This rate may be reduced to 12 drops per minute after assurance that all line shaft bearings have received ample oil. The pump should not be operated without water. An inadequate supply of water while pumping should also be avoided as the water may be caused to

pass through the pump in surges, thus throwing the pump out of balance and causing harmful vibrations to develop, which may cause thrust bearing trouble. Note the presence of any debris which may have accumulated around the suction that would restrict the flow or damage the pump should it be allowed to pass through. Even though trash racks are provided at the inlets to the pumping pit, the possibility that some undesirable objects may have worked through between the trash rack bars, or have been left in compartment by workmen, should not be overlooked.

- (c) Check the oil and grease lubricating pipes provided to carry the lubricant to the pump bearings and note any indication of leakage at any point with particular attention to the connection at the pump housing. Also make note of any unusual noise that might indicate that the lubricant is not reaching the bearings. The grease seal packing rings on the pump drive shaft should be checked occasionally as they may become dry and harden to the extent of scoring the shaft and/or failing to adequately retain the lubricant. For location of the packing rings refer to the applicable shop drawings. Carefully inspect the feed oilers to insure that they are functioning properly, and when set to permit the oil to feed to the bearings it will remain set while the pump is operating. Note any indication that the oiler feed control has become worn, loose, etc., to impair its proper functioning. Check the functioning of the feed oiler control to insure that the control valve is being held open to admit the lubricant when the pump is running. Occasionally check the grease lubrication pipe which runs to the bottom of the pump suction bowl to insure that it has not broken off or otherwise damaged..
- (d) Inspect the anchors at the pump operating floor, and note any indication of movement of the pump units, and loose bolts.
- (e) Inspect the discharge connections for signs of leakage at the couplings or vibration while the pump is operating. Check flap gates in the discharge lines, note any abnormal noise or sluggishness of movement in opening or closing; with only one of the three pumps operating, note any flow back through the stationary pumps which would indicate that the gate is not seating properly.

- (f) Inspect the pump driving shaft and couplings for alignment, and note any tendency for the shaft to vibrate, or any looseness in the couplings and connections. Worn shaft bearings will cause the shaft to vibrate, however, in some instances it may not be easily detected without the use of special instruments.
 - (g) Carefully inspect all metal work, and note any indications of rust, leakage when pump is operating, abnormal wear or other signs of deterioration.
 - (h) Insofar as practical occasionally check the ability of the pump to deliver the required capacity and note any indication that the pump is in need of adjustment, suction lines restricted, or debris in the suction bell.
- (2) Motor.
- (a) Carefully inspect the motor to insure that it is being properly lubricated. Check especially the oiling system for proper functioning, as well as the supporting brackets and pipe connecting from oiler to the bearing in each instance. Note especially any leakage at the connections, loose bracket or worn parts of the oiler assembly. Feel the bearing housings while the motor is operating and note any indication of abnormal heating at these points. Also note any unusual noise or vibration which would indicate that the bearings require attention and/or the unit is out of balance. Any clicking noise while the motor is running may be due to a cracked ball in the bearings, or some loose part and must be immediately corrected.
 - (b) Note any oil leaking by the oil seals, or any oil on the outside or inside of the motor housing.
 - (c) Check the motor for smoothness of operation under full load and note any abnormal noise or vibration of the assembly.
 - (d) Inspect the motor for signs of excessive temperature rise due to an apparent overload or other causes. This condition should be reflected in the switchboard ammeter.
 - (e) Check the functioning of the motor controls especially when starting up under load. Note especially any failure of the motors to "pull in" throughout the range of loads encountered.

- (f) Check the motor base anchor bolts to insure tightness also note any indication that the motor base has shifted on its support. While checking the motor base also inspect the coupling connection at the juncture of the motor pump drive shaft, and note any indication of wear, looseness or start of fracture. Inspect bird screens where provided to insure that they are in place and properly installed.
- (g) Check supply of spare parts if any on hand and note need for replenishment of supply.
- (h) Carefully inspect all metal work and note rust spots and need for repainting or repair.
- (i) Note collections of oil, dust or other material on or around the motor assembly which may constitute a possible fire hazard. In any event it should be removed.
- (j) When initially starting a motor after it has been previously removed and reinstalled check for correct direction of rotation before applying full load.

c. Trash Racks.

- (1) Occasionally check the metal work and note any rust spots, need for painting or other maintenance.
- (2) Note the presence of debris including rags, weeds, etc., which may be clogging the openings through the vertical bars. Also note the presence of debris in the collection sump, immediately upstream from the trash racks, which can be expected to move against the rack and which should be removed. (See sheet No. 1 of Exhibit D).

d. Discharge Gates and Hoists.

(1) Slide Gates.

(a) Gates.

- 1. When accessible the gates should be carefully inspected to insure that all frame and guide anchorages are sufficiently tight, that the gate leaf has freedom of movement, and that gate opening and guides are not clogged with debris to limit or restrict the gate.

2. Inspect the condition of all metal work and other materials making up the assembly and note need for repair or replacement. Also inspect the gate seal bearing surfaces and note need for maintenance. (See sheets 4 and 5 of Exhibit D).

(b) Hoist.

1. Check the hoist and note any indication of binding, abnormally excessive hand force required to operate the hoist, and need for lubrication.
2. Check condition of the hoist stem assembly including the guides and anchorage. Give particular attention to stem guide anchors and appurtenances. Note any indication of dirt, etc. on the hoist screw which may cause excessive manual effort to operate hand wheel.
3. Inspect all metal work including the hoist assembly, supporting structure, and associated appurtenance and note any need for maintenance.
4. Check condition of the gate well access cover and note any indication of deterioration or hazard. It is good practice to provide suitable means for locking the covers in place and having key retained by plant operator or other authorized personnel in order to prevent ready removal by other than authorized personnel.

(2) Flap Gates.

- (a) Inspect the metal work making up the gate assembly and note need for maintenance.
- (b) Note any improper functionings of the gate, including any indication of leakage when closed, limited or sluggish travel when operating as well as any debris which may be present to foul the movement of the flap in opening or closing. Check looseness of hinge anchor bolts and hinge pin wear. Where manual operated hoist is provided, inspect for adequate lubrication, signs of rusting, loose anchor bolts and ease of operation. Note any excessive accumulation of dirt and hard grease on the screw stem which may be the cause of excessive hand effort required to operate the hoist.

e. Staff Gages.

- (1) Inspect the gages to insure that all are in place and in good state of repair.
- (2) Note need for painting or other maintenance.

f. Pumping Plant Structure.

At least once each year thoroughly inspect the entire structure and note need for painting or other maintenance required to restore to its original condition. Note also excessive erosion of the surrounding area, inadequate or clogged drainage, etc. (See sheet 1 of Exhibit D).

g. Electrical System.

(1) Float Operated Controls.

- (a) Check the controls for proper functioning. Insofar as practical inspect the inside and outside of the float wells for any indication of debris which may interfere with the operation of the float including possible restriction of water inlets. (See sheet 2 of Exhibit D).
- (b) Inspect all metal work for indications of rusting, objectionable accumulation of dust, etc.
- (c) Insure that the operating mechanism is properly lubricated and sealed. At least twice a year remove the cover and inspect the mechanism located there for proper functioning, adequate lubrication and note any indications of water, dirt, etc. which may have accumulated.
- (d) Insure that the base anchor bolts are secure and that float line is in true alignment with centerline of the float. Also note any indication of wear or other deterioration of the line assembly including connections at float and driving unit. Occasionally inspect the float for possible damage.
- (e) Check electrical wiring and connections from controller unit.

(2) Main Switch Board.

- (a) The main switch board panel, switches, instruments, and appurtenances should be kept clean and free from dust. Doors of all cabinets should be kept closed, and locked.. (See sheet 3 of Exhibit D).

- (b) Check the switches and controls to insure that they are mechanically and electrically operable. Note especially any indication of sluggish operation.
- (c) Note any of the instruments such as meters and recorders which are not registering properly. Check the supply of recording charts on hand and note need for replenishment of the supply.
- (d) Note especially any indication of loose connections, insulation deterioration, unusual odors or mechanical failure within or around the switch boards.
- (e) Note any failure of the controls on the respective panels to control the operation of the units for which they are intended.
- (f) Note the need for cleaning or other maintenance and insure that the access gate is properly locked at all times except during necessary inspection and maintenance periods.
- (g) Circuit Breakers.

1. Oil Type. The main points to be observed in the inspection of an oil circuit breaker are: condition of the oil; condition of contacts, and whether the operating mechanism works freely yet is positive in closing, latching and tripping. The inspector should, while observing their condition, lubricate pins and bushings subject to wear, see that all others are in place, and that all bolts, nuts and set screws having to do with the breaker structure are set tight. Note also any evidence of heating, wipe off all the breaker bushings and check for cracked bushings.
2. Air Type. The same general points should be observed in going over the operating mechanism of an air type breaker.
3. Safety. Before approaching a circuit breaker for general inspection, sufficient precautions should be taken to guarantee the safety of the personnel and also prevent damage to the apparatus. The circuit breaker shall be de-energized by opening the breaker and also main disconnecting switch on the switchboard. The control circuit and closing source of power should be cleared to prevent damage or injury from mechanical operation.

(h) Starters.

1. Inspection of the starters should be made at regular intervals for best results—at least once a year and during the period of normal operation. Before removing cover to inspect or adjust the starter make sure that disconnecting switch is open and that the control circuit is de-energized.
2. Check all connections and note any that are not adequately secure.
3. Check to insure that all moving parts work sufficiently free and observe burnings on the contact tips. Also note if there is any indication that not all of the contacts close at the same time.
4. Disconnect the motor starting switch and test the start button, stop button and relays.
5. Make note of any indication of mechanical and/or electrical failure at any point or other points requiring maintenance attention.
6. Note any indication of failure of sequence to close or open properly.

(i) Contactors.

1. Inspect the contactors for proper functioning. Note any indication of excessive heating and check to insure that they have correct travel, correct contact pressure, that the contact surfaces are clean, and that all connections are clean and tight.
2. Check to insure that all moving parts have adequate clearance to move and are not undesirably restricted by mechanical interference or friction.
3. Check the contact gap with the contactor fully open and note any need for adjustment or other attention.

(3) Miscellaneous.

- (a) Note whether all light fixtures and controls are functioning properly and are clean. The flood light fixtures should be clean inside and out. Check the flood lights at night for proper adjustment.

- (b) Inspect the circuit breakers and switches and note any indication that maintenance is required. Also check adequacy of the number of spare fuses on hand.
- (c) Periodic inspections at least every year should be made of the entire electrical system provided for operation of the main pumping units.
- (d) Reliance for power to operate the electrical facilities is placed on the Utility Company. Any conditions noted in the inspection that may effect in any way the reliability of the power supply should be especially noted and brought to the attention of the Utility Company in writing or other accepted practice without delay.

h. Painting. At least once each year carefully inspect all painted surfaces and note need for repainting or other maintenance.

i. Hazards.

- (1) Check to insure that the proper warning notices are legible and properly posted.
- (2) Check all access manholes and note any covers not in place or in need of maintenance.
- (3) Insure that the access to the main switchboard is kept locked to exclude unauthorized persons.
- (4) Note presence of any grease or oil accumulations on floor which may contribute to a fire or slipping hazard.
- (5) Inspect the concrete structure for signs of abnormal cracks or other conditions requiring maintenance.
- (6) Be certain no tools, rags, etc. are left on oil switches, circuit breakers, motors or any normally electrical charged portion before applying power.

5-03. Maintenance.

a. General. Since proper functioning of the pumping plant is vital to an adequate operation of the drainage system, it is essential that all equipment, controls and appurtenance be continuously maintained in good operating condition. The subjects of maintenance and procedures can be only briefly touched upon herein and should be expanded and improved upon as continued experience is gained in operation of the equipment, and as new improved procedures are developed to expeditiously and efficiently handle the special problem which may arise. All damaged or unserviceable parts shall be repaired or replaced

without delay. Before attempting major repair, the applicable contract plans, shop drawings, specifications, as well as catalogs, descriptive data and operating procedures supplied by the manufacturers of the equipment installed should be carefully reviewed. Certain specific points as pertains to the principal units are discussed below; however, full use shall be made of all pertinent technical data furnished with the respective units especially as pertains to repairing and adjusting the main pumping units. For special points requiring maintenance, refer to the periodic inspection reports. Use high grade lubricants which are suitable for the service and in all instances, in accordance with the equipment manufacturers recommendations. Painting required should be performed in accordance with the original contract specifications. All necessary maintenance work shall be performed by skilled mechanics and electricians; where replacements are made the replacement parts shall be equal in quality to those originally installed or of suitable later improved design. For records required to be maintained and reports to be made see paragraph 5-04 of this manual. See also paragraph 208.10(f) of the Federal Regulations, EXHIBIT A for further pertinent maintenance and test requirements. Exhibits F, G, and H of this manual will serve as guides and check lists for conducting the inspections and preparation of reports.

b. Drainage Pump-Motor Units.

(1) Pumps.

- (a) If excessive vibration or noise occurs when the pump is operating the cause for which is not readily apparent, consult with an authorized representative of the pump manufacturer. It is absolutely necessary to determine whether mechanical or hydraulic conditions are causing the trouble in order to find a remedy for it. Persons untrained in pump engineering and operation should not be engaged to "trouble shoot" insofar as concerns major problems relating to the pump unit itself. The plant operator, or responsible authorized person should be instructed to immediately stop the pump the instant an unusual noise is discovered, rather than wait to consult with someone else; inasmuch as prompt action may avoid serious damage to the pump. A relative sudden development of abnormal noise or vibration may be due to numerous causes such as bearing failure, loose anchors, or debris sucked into the pump.
- (b) When installing, adjusting and performing general maintenance make full use of the "Installation and Operating Instructions" prepared by the pump manufacturer for the pumps installed.
- (c) In general the pumps are of relative simple, rugged design and normally will require very little maintenance except for keeping the machinery clean and properly

lubricated. High grade lubricants shall be used in each instance; however, it is undesirable to use more oil than the instructions call for. Careful and frequent inspections will in most instances reveal sources of possible trouble before they have had a chance to require a major repair operation to be performed.

- (d) When it becomes necessary to pull or disassemble the pump unit to inspect, adjust and repair, all parts put back shall be thoroughly cleaned. At this time the bearings should also be carefully cleaned including removal of the old lubricant. The points required to be lubricated and methods provided are indicated on the approved shop drawings included herewith. The pumps are lubricated by a solenoid lubricator, two quart capacity to lubricate the lower intermediate and upper bearing bushings. The bottom suction bowl bushing assembly is provided with a pressure grease fitting. The points provided for applying the lubricant in all instances are accessible from above the pump operating floor. The feed oiler provided for the pumps should be set to deliver approximately double the normal requirements for the first five hours (30 drops per minute) of an initial operation; also apply a generous application of grease at the pressure fitting. Delay initial starting of the pump sufficiently to allow time for the lubricant to reach the bearings in each instance. After the initial lubrication repeat the lubrication by means of the pressure gun about every 12 hours during operation and keep the feed oiler full using the grade of lubricant recommended by the pump manufacturer. Lubricating is the most important phase of pump maintenance and should be checked daily (during periods of pumping operations) but the lubricant should only be added as required as excessive lubrication is wasteful. Normally around 12 drops per minute will be adequate. It is not enough merely to apply the lubricant at the points provided as it must also be assured that the lubricant is reaching the bearings in each instance. In the case of the feed oiler it should be carefully checked to insure that it is adjusted and functioning properly to feed the lubricant to the bearings in the required amount when the pump is running and that it is not loose or worn to a point where it will be jarred out of adjustment by the normal vibration of the assembly. If any problems develop with the feed oiler which cannot be readily corrected; replace with a new oiler assembly, also check electrical connection and replace where there is an indication of possible failure.

- (e) Note location of oil seals provided for the pump bearings to prevent leakage of lubricant from the bearings and also to prevent foreign matter from entering the bearings. Excessive lubricant consumption requires replacement of seals. Replace the seals with new when the pump is disassembled for servicing or more frequently if required.
- (f) In tightening bolted connections use suitable size and proper type of wrench to avoid possible undesired overstressing of the threads and or marring the heads of the bolts and nuts. When assembling the discharge line to the pump tighten the bolts, each a little at a time to pull the seals together evenly and exercise care to insure against the possibility of pulling the pump out of line or throwing an undesired strain on the pump unit. After completing the assembly of the pump to the discharge line carefully recheck the alignment of the pumping unit.
- (g) It will be noted that the drainage pumps discharge into a common distribution box and a flap gate is installed in their respective discharge line to prevent feed back through the respective pump. These flap gates must be in proper operating condition at all times and any failure of this gate to operate properly shall be carefully investigated and the necessary maintenance performed without delay. Inspect those points noted on the inspection report and perform such maintenance as required. Give particular attention to the flap gate hinge bearing and support assembly, and where the steel portions have become deteriorated by corrosion requiring replacement.
- (h) The pumping pit is protected by a trash rack on the supply entrance from the drainage system; however, it is possible that rags, etc, may work through which could wrap around and restrict the pump suction, or in a similar manner foul the movement of the flap gates and prevent an adequate closure. Any debris noted on the inspection report which might clog or damage the pump should it be allowed to pass through the pump should be removed from the pumping compartment.
- (i) Any rust spots noted during the inspection shall be carefully cleaned with a wire brush or other suitable means and repainted in accordance with the original specifications. Unpainted surfaces such as exposed shafting, etc., which have corroded shall be carefully cleaned and coated with water proof grease or suitable rust preventative.

This and similar maintenance not classed as an emergency should be performed once a year and during the non-operating period when most practical.

(2) Main Pump Motors.

- (a) Carefully investigate all items noted on the inspection report and perform such maintenance as found to be required. Read "Manufacturers Instructions" carefully before installing or operating. Refer to "Motor Name Plate" for proper instruction identification. Assure that the motor bearings are being adequately but not excessively lubricated at the points provided in each instance and that the lubricant is reaching the bearings. Refer to the data provided on the name-plate of the motor in each instance as well as the applicable Manufacturers Instruction sheet. Lubrication pipes to the bearings must be kept tight. Supporting brackets provided for the lubrication pipes, sight indicators and appurtenances must be adequately secured to eliminate undesired vibration and noise. Constant vibration of the pipes and appurtenances may result in broken or loosened pipe connections or cause the automatic oiler to be thrown out of proper adjustment. Very little oil should be required to be added and where an abnormal drop in the oil level is noted at the inspection point, or other indications of excessive use of oil, the cause must be immediately investigated and corrected. Note for signs of any oil leakage around the oil reservoir or oil piping and feel the bearings to determine whether or not there is any indication of the bearing becoming overheated and if so, shut down the unit.
- (b) When installing the pump motors, insure that the base when installed is level and that the connecting coupling is tight. When tightening the anchor bolts, tighten down the nuts gradually and uniform all around using a wrench of suitable size to permit adequate but not excessive tightening. Before installing shaft coupling, start motor and check to insure that the rotation is in the proper direction, as the pump unit must not be allowed to operate in reverse rotation.
- (c) Should the motor pump unit be allowed to remain idle for any length of time occasionally make a start and short running test to determine whether the unit including the starter and control are in proper operating condition. Any major repairs or adjustments must be performed only by skilled mechanics and or electricians thoroughly experienced with the type of equipment involved.

c. Trash Racks.

- (1) The trash racks are provided to prevent debris from entering the pumping compartment that might otherwise tend to clog or damage the pumps. These racks should be kept free from debris.
- (2) Any signs of rusting of the metal work shall be thoroughly cleaned and painted.

d. Discharge Gates and Hoists. The gates and hoist equipment shall be carefully inspected and carefully maintained. Any indication of binding, misalignment, and/or abnormal force required to operate the hoisting equipment should be carefully investigated and the necessary maintenance performed.

(1) Slide Gates.

(a) Gate. When the gate is accessible all anchor bolts should be checked for tightness. When tightening any of the bolt nuts, use a wrench of suitable size to avoid overstressing the threads or pulling the frame and guides out of alignment. It is advisable to occasionally remove the gate leaf when conditions permit, and thoroughly clean off all metal or other parts of the assembly, replacing excessively worn or otherwise deteriorated parts. Apply a suitable coat of preservative material before reinstalling. Coat the sliding surfaces including the seal bearing surfaces with water-proof grease. Also coat the gate leaf stem assembly including guides with a heavy coat of water-proof grease.

(b) Hoist.

1. Perform such maintenance as found to be required during the inspection. Keep the hoist screw, gears, and hoist stem well lubricated with a suitable waterproof grease. Should abnormal force be required to operate the hoist, check hoisting screw and nut, and if found advisable, disassemble, thoroughly clean with a suitable cleaning solvent, lubricate and reassemble. If the parts are worn excessively replace the stem and nut with new parts. Application of grease to the section of the hoist stem projecting above the hoist may be objectionable due to accumulation of dust during the relative long periods between hoist operations, and if left unlubricated, inspect frequently; also it is advisable to apply a film of light lubricant to the stem and gears before hoist is operated.

2. The gate well access cover shall be adequately maintained at all times so as not to constitute a potential hazard. Provide an adequate lock for the assembly to prevent removal by other than authorized persons. After maintenance and inspection operations are completed exercise special caution to insure that the covers are replaced and secured.

(2) Flap Gates.

- (a) When practicable, carefully remove all rust from the metal work and repaint or otherwise coat with approved protective material. It would be well to apply a heavy coat of waterproof grease or suitable rust preventative to the hinge assembly and linkage.
- (b) For suitable protective coating for steel subject to constant immersion and abrasion refer to applicable American Water Works Association Standard Specifications and similar accepted sources for best approved practice.

e. Fire Protection. Refer to applicable provisions of "Recommended Good Practices of the National Board of Fire Underwriters," and applicable safety manuals. If fire extinguishers are provided, insure that the proper type is being provided for the type of fire that might be expected in the particular area involved. Proper emphasis shall be directed to strictly enforce all fire prevention rules by frequent and careful inspections. No combustible materials shall be allowed to accumulate on or around the pumping plants. Any rags, paper, etc. containing oil, paint or cleaning fluid shall not be allowed to accumulate - not even for a period of one day. Oil and grease dripping or other undesired accumulations shall be promptly removed. During any welding operations performed be especially careful to remove or properly isolate any material that might be so ignited or damaged by the welding procedure. Take prompt corrective action relative to any electrical equipment which shows signs of sparking. Approved fire prevention instructions and warnings shall be properly posted.

f. Staff Gages. Maintain these installations in a good state of repair. Any broken or damaged gages should be replaced or repaired at the earliest practical date. Keep well painted in accordance with the original contract specifications.

g. Pumping Plant Structure.

- (1) At least once each year thoroughly inspect the entire structure and perform any required maintenance to restore to its original condition insofar as can be justified.

h. Electrical System.

- (1) General. Give particular attention to the items listed on the inspection report and perform such maintenance required in accordance with the best standard practice for the service with due consideration of all safety precautions. Only qualified mechanics and electricians experienced in the type of equipment involved shall be allowed to perform such maintenance. Maintenance of the power line is the responsibility of the Utility Company. A large percentage of electrical failures are due to mechanical failures. Generally, no simple device is available for locating the source of or analyzing the noise with the consequence that the action taken must depend primarily upon the judgement and experience of the maintenance personnel. When cleaning any part of electrical equipment use ample precautions to prevent explosions, fires or toxic conditions. Use only approved cleaners with relative low flash points.
- (2) Main Switch Boards.
 - (a) Main Switch Boards, panel boards, switches, controllers, and appurtenances shall be kept clean and free from dust preferably by blowing with dry compressed air if available. Care should be taken to insure that the air does not contain moisture. Air should not be used for cleaning instruments. Air in excess of 30 lbs. should not be used on insulation or coils such as motors or solenoids. Doors of all cabinets shall be kept closed to exclude dust. Switches shall be kept mechanically and electrically operable at all times.
 - (b) Circuit Breakers. Periodically inspect, test, adjust and overhaul, if required, circuit breakers about once each year. Before attempting these or similar maintenance operations first insure that power is disconnected from the board; also consult the applicable catalogs and technical bulletins supplied by the manufacture of the equipment for a detailed description of the unit and recommended procedures for operation and maintenance.
 - (c) Starters.
 1. Carefully investigate all points noted on the inspection report as requiring attention. Before removing cover to inspect or to adjust, make sure that disconnecting switch is open and control circuit is de-energized.

2. Insure that all parts are clean and move freely.
3. Any excess deposits should be removed from the inside surfaces of the arc boxes adjacent to the contacts, and any broken arc boxes should be replaced.

(d) Electrical Contacts.

1. Copper Contacts. If excessive heating is noticed during the inspection period, the most likely point of high resistance (and resultant heating) is where the movable tips make contacts with the stationary tips. If this condition is noticed, dress the contacts with a few strokes of a file. Since copper oxide has a very high resistance and forms on copper contacts rapidly at higher temperature, a few strokes with a file will remove the oxide and reduce the resistance to a low value again. It should be pointed out, however, that contact tips which have been roughened by ordinary service do not have to be kept smoothed so that they will carry the load. A roughened tip will carry current just as well as a smooth tip; however, if large projects should appear on a tip because of unusual arcing, they should be removed. Contacts plated with a small layer of silver should be cleaned with a clean cloth or brush dipped in cleaning fluid. After being cleaned polish the contacts with a clean dry cloth. The brown discoloration that is found on silver and silver-plated contacts is silver oxide which is a good conductor. It should be left alone unless the contacts must be cleaned for some other reason. When corroded, contacts should be cleaned with No. 0000 sandpaper. This must be done very carefully so as not to remove too much of the silver plating. After the corrosion has been removed polish the contacts with a clean, dry cloth making certain that all abrasive particles are removed and that the shape of the contact has not been changed. Silver-plated contacts that are badly burned or pitted should be replaced. In the event no replacement is on hand at the site, the contacts may be dressed with sandpaper until the burned or pitted spots are removed. If the burns or pits can not be removed by using sandpaper, then use a burnishing tool very carefully. In only extreme emergencies will the use of a file on silver-plated contacts be permitted. In no instance shall highly

abrasive materials, such as emery cloth, heavy sandpaper or carborundum paper be used for surfacing relay contacts. In adjusting the contact pressure refer to the manufacturers recommendations and check by the spring balance or other approved methods. In case the contact pressure is below the minimum value required, adjust or install a new spring. Low pressure should be avoided to minimize possibility of excessive heating of the contacts. On multiple pole devices, the spring tension on all poles should be approximately the same and if one is considerably lower than the others, the spring should be replaced.

2. Avoid the use of lubricant on the contacts or bearings of a contactor as oil quickly collects dust and unless parts are frequently cleaned, will interfere with the operation of the contactor.
 3. Maintain the contact gap in accordance with the manufacturers instructions.
 4. Failure to close may be due to one of the following:
 - a. Operating coil may be open-circuted.
 - b. Lead wires to operating coil may be loose or disconnected.
 - c. Excessive mechanical friction.
 - d. Power off or voltage below normal.
 5. Failure to open may be due to one of the following:
 - a. Mechanical interference or friction.
 - b. Welded contacts.
 - c. Broken contact spring.
- (e) All wiring connections in the rear of the switchboards shall be inspected yearly before the pumping season in order to insure that there are no loose contacts and that proper clearances are maintained. All parts of the panel board should be kept clean. Branch circuit breakers which are not normally required to be closed shall be kept in the "OFF" position. The bus

voltage should be checked for a phase balance daily and especially after utility service has been restored following an outage.

(3) Miscellaneous.

- (a) Lighting. The lighting circuits shall be maintained in operable condition at all times. Light which has burned out shall be replaced without delay. The lighting fixture shall be cleaned at least once a year, removing all dust and insects. Keep an adequate supply of fuses and light bulbs on hand at all times.
- (b) Maintain all other electrical equipment clean, adequately lubricated and in proper operating condition at all times in accordance with best practice for the service, with particular attention to those items noted on the inspection report.

(4) Cleaning Electrical Equipment.

- (a) Compressed Air. Air pressure used for cleaning electrical equipment should not exceed 30 psi. When using compressed air certain precautions should be exercised as set forth in (2) above.
- (b) Vacuum. This method of cleaning is especially applicable in removing copper dust and other waste materials.
- (c) Solvent. If dry cloth or compressed air is not sufficient to remove gummed dirt or grease from electrical apparatus, use carbon tetrachloride as a solvent for cleaning. Moisten the cloth sparingly with carbon tetrachloride and wipe off the dirt from the parts to be cleaned. Be sure to have adequate ventilating and avoid inhaling the fumes. Never use gasoline, benzene or bensol for cleaning as these solvents are highly inflammable; their vapors are explosive, and may be corrosive or will dissolve certain types of insulation.

5-04. Records.

a. Procedures for inspection, maintenance, and testing of the pumping plant equipment and appurtenances shall include the requirements set forth in paragraph 208.10(f) of the Federal Regulations, EXHIBIT A of this manual. Inspection Check List, EXHIBIT F, Lubrication Schedule, EXHIBIT G and other descriptive material contained in Section III of this manual will serve as a guide in meeting these requirements, and in the maintenance of required records and logs.

b. Maintenance card or cards should be kept for each major piece of equipment for recording a summary of, test results, inspection and repairs, and any pertinent comments regarding the condition of the equipment. Such cards should be kept up to date and filed at an approved location so as to be readily available to those responsible for inspection, testing and maintenance. A data card should be prepared for each piece of equipment or component thereof consistent with the maintenance program breakdown to provide a record of project equipment. The data card records should indicate all name plate data and other historic information that would indicate, at least, but not necessarily be limited to, source of manufacture, physical characteristics, date of purchase, cost of procurement and list of spare parts available.

c. Flood Period Log. A record or log of pumping plant operations shall be kept during flood operating period, a copy of which to be furnished the District Engineer following each flood, all in conformance with applicable requirements of paragraph 208.10(f), EXHIBIT A of this manual. An Operation Log, form EXHIBIT H has been prepared as a general guide in satisfying above requirements, but may be modified and expanded as required to adapt it to the particular operating period observed, and special conditions which may arise.

EXHIBIT A

FEDERAL FLOOD CONTROL REGULATIONS.

EXHIBIT A

TITLE 33—NAVIGATION AND
NAVIGABLE WATERS

Chapter II—Corps of Engineers, War
Department

PART 208—FLOOD CONTROL REGULATIONS
MAINTENANCE AND OPERATION OF FLOOD
CONTROL WORKS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(iv) To 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;

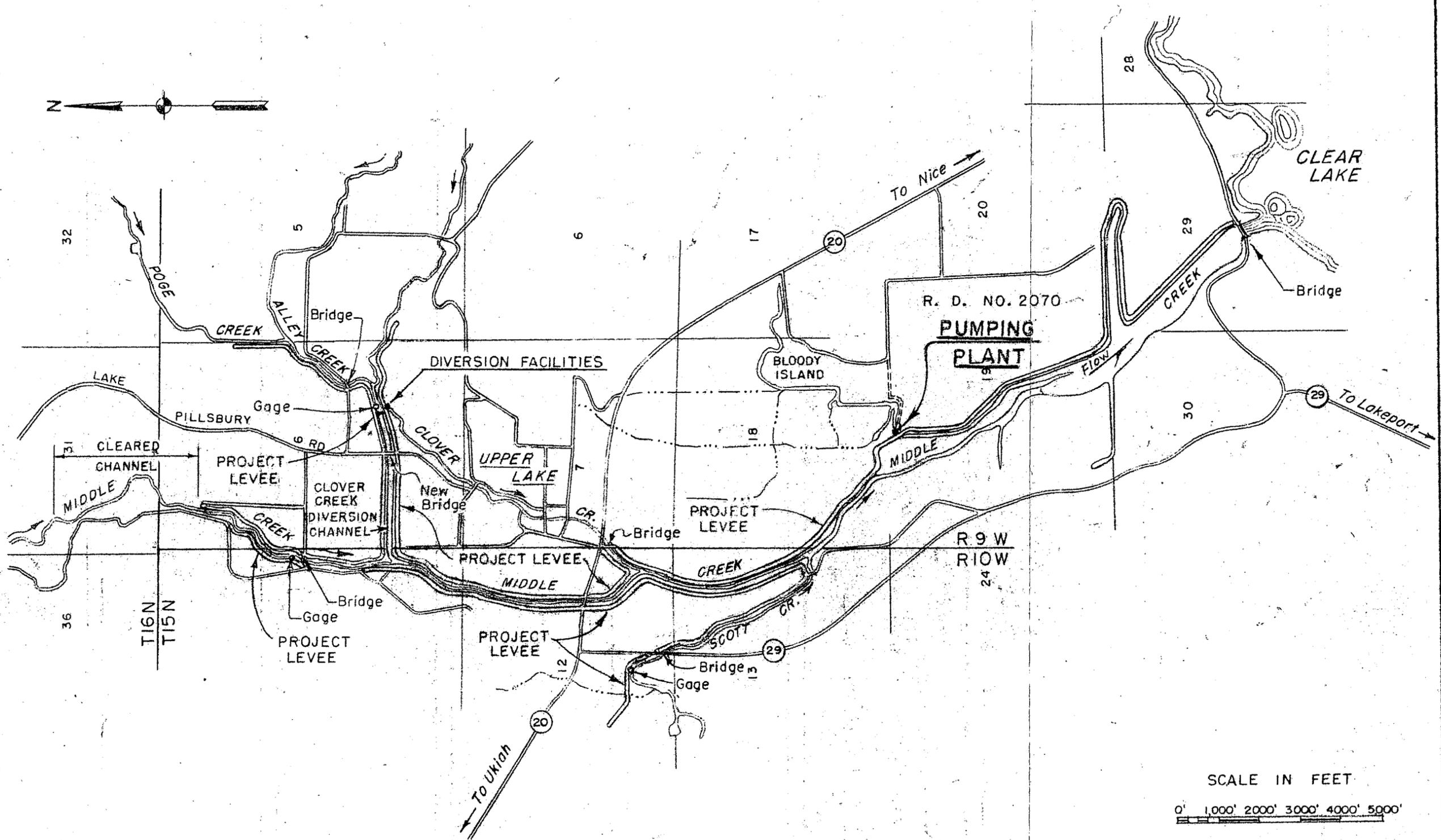
(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) The 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 month 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 and/or cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

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



LOCATION MAP
 MIDDLE CREEK - PART I
 PUMPING PLANT

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.

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

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

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

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

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

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

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

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

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

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

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

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

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

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

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

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

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

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

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

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor, (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 838; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE BPEWF)

[SEAL]

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

[P. R. Doc. 44-12286; Filed, August 16, 1944; 9:44 a. m.]

EXHIBIT "A" Sheet 2 of 2

EXHIBIT B

"As Constructed"

Drawings

(See Separate Folder for the Following Drawings)

(Drwgs. No. CC-4-25-28)

Pumping Plant for Interior Drainage

<u>File No.</u>	<u>Title</u>
28/1.2	Location Map, Road Sections and Soil Logs.
28/2.2	Levee & Road Ramp, Plan & Sections
28/3.1	Pumping Plant Site & Outlet Structure Details
28/4.3	Plans, Sections & Details, Mechanical
28/5.1	Trash Rack & Miscellaneous Details
28/6.2	Plans, Sections & Details, Structural
28/7	Gate Riser Units, Fencing & Details
28/8	Electrical Work

EXHIBIT B

EXHIBIT C

MANUFACTURERS DATA

(See Following Manufacturer's Data Under Separate Covers)

1. The Louis Allis Co. - Electric Motors Specifications
2. Cascade Pump Company - Spare Parts Catalog
3. Cascade Pump Company - Laboratory Test Report
4. Approved Shop Drawings

PLANT DETAILS

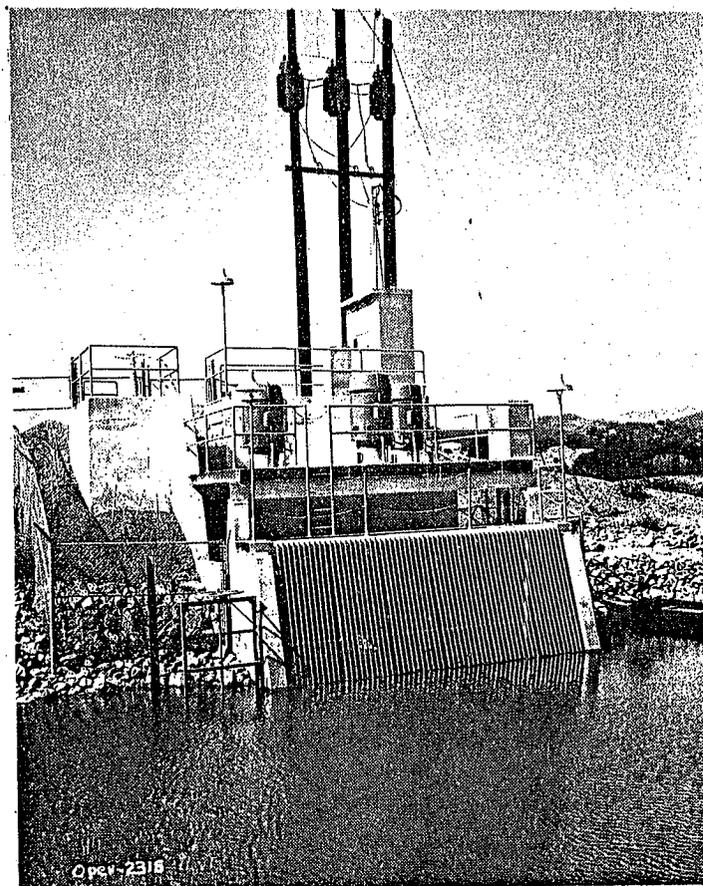
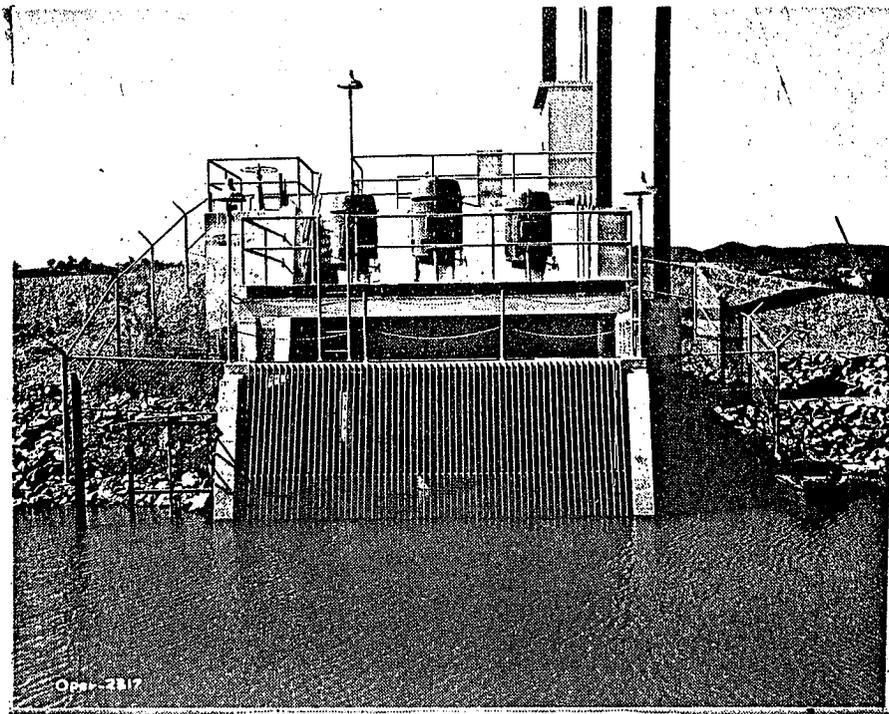
- Plate 1 - Vicinity Map
Plate 2 - General Plan Layout
Plate 3 - Plan and Elevation
Plate 4 - Sections

EXHIBIT C

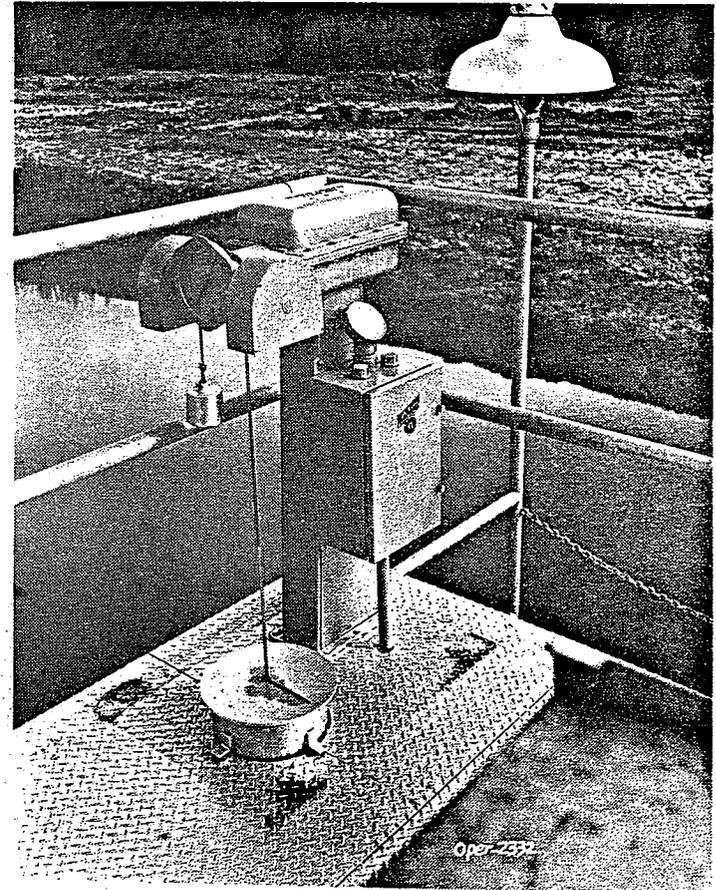
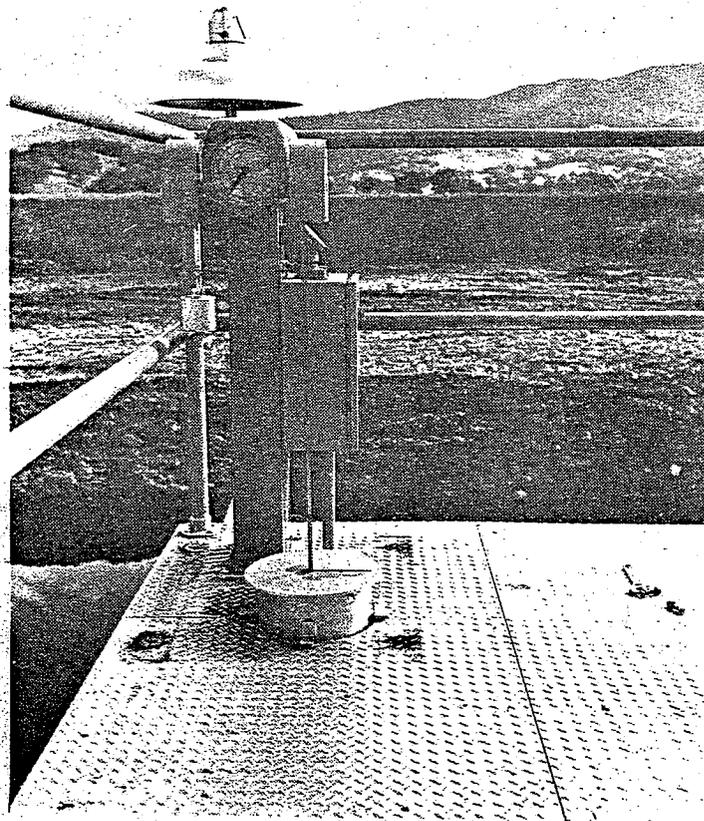
EXHIBIT D

Photographs of Pumping Plant

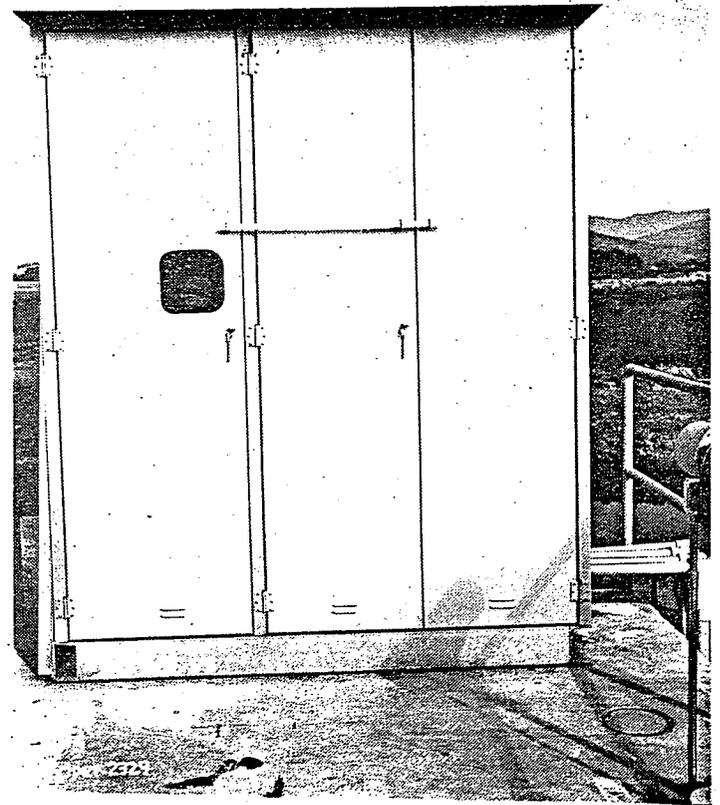
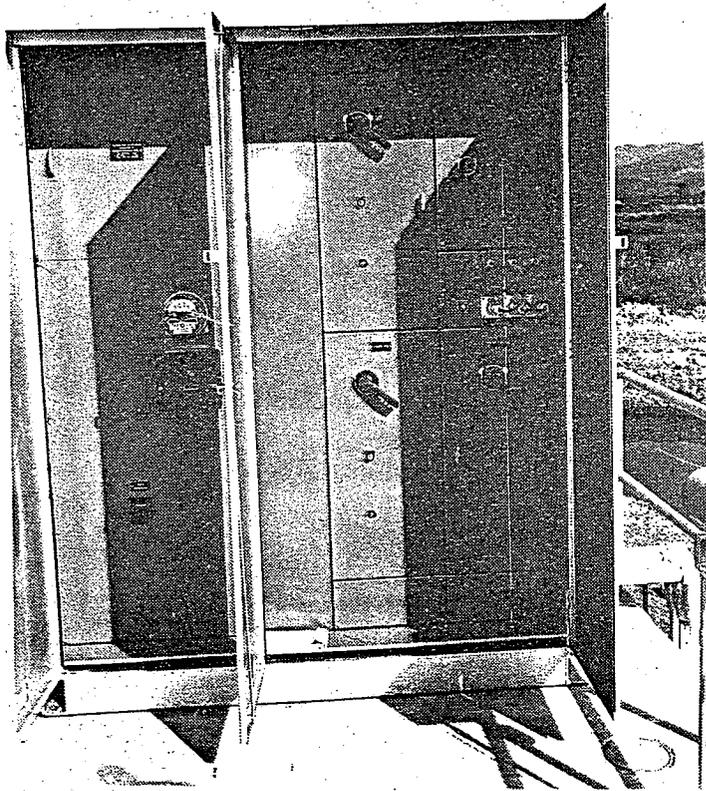
EXHIBIT D



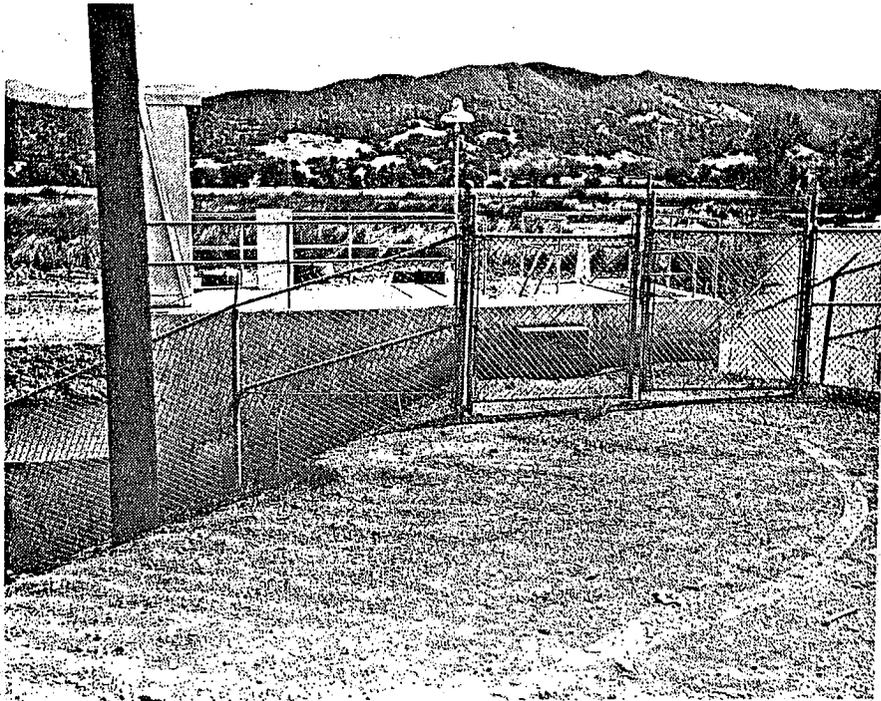
PUMPING PLANT INLET



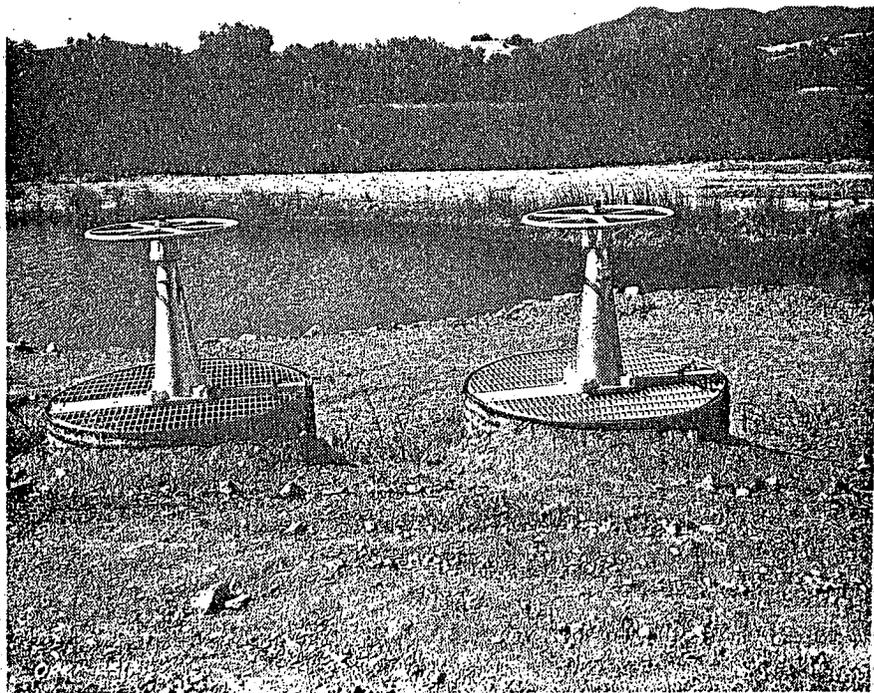
AUTOMATIC FLOAT OPERATED PUMP CONTROLLER
(Enclosure Removed)



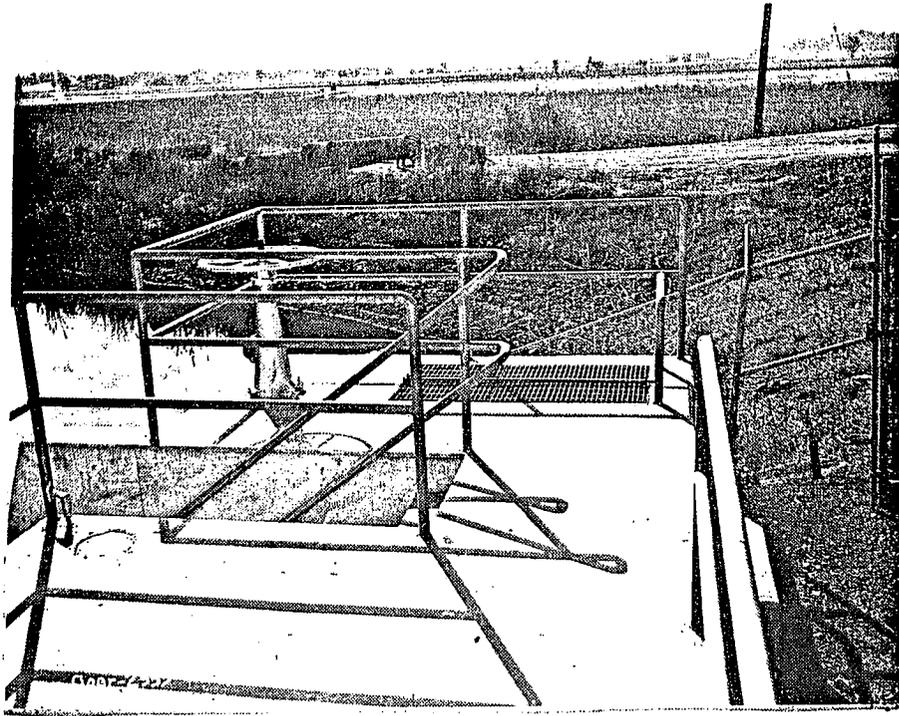
MAIN SWITCHBOARD



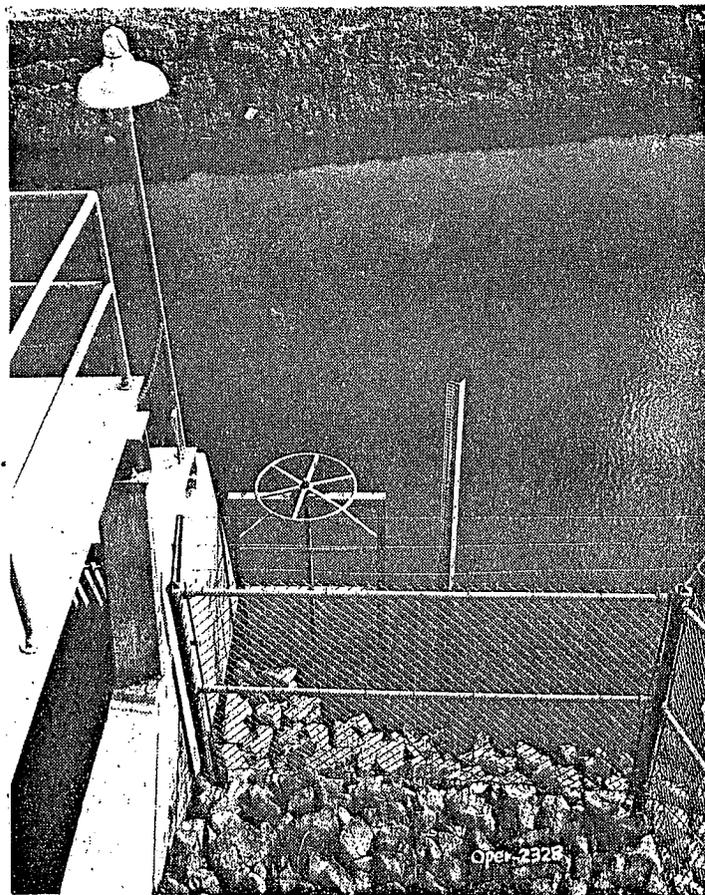
VIEW OF PLANT FROM TOP LEVEE



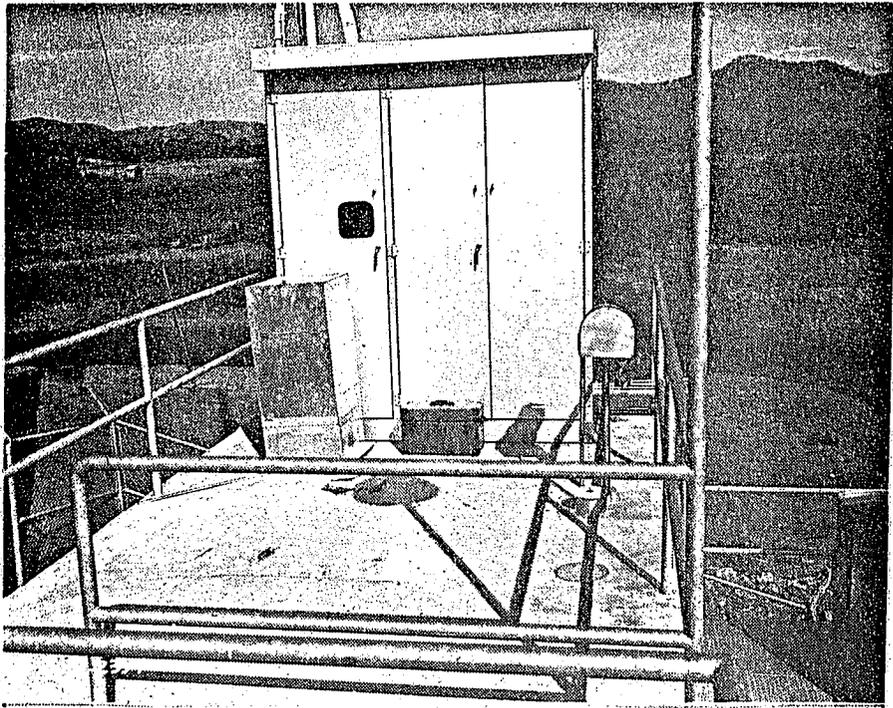
SLIDE GATES IN DISCHARGE CONDUITS



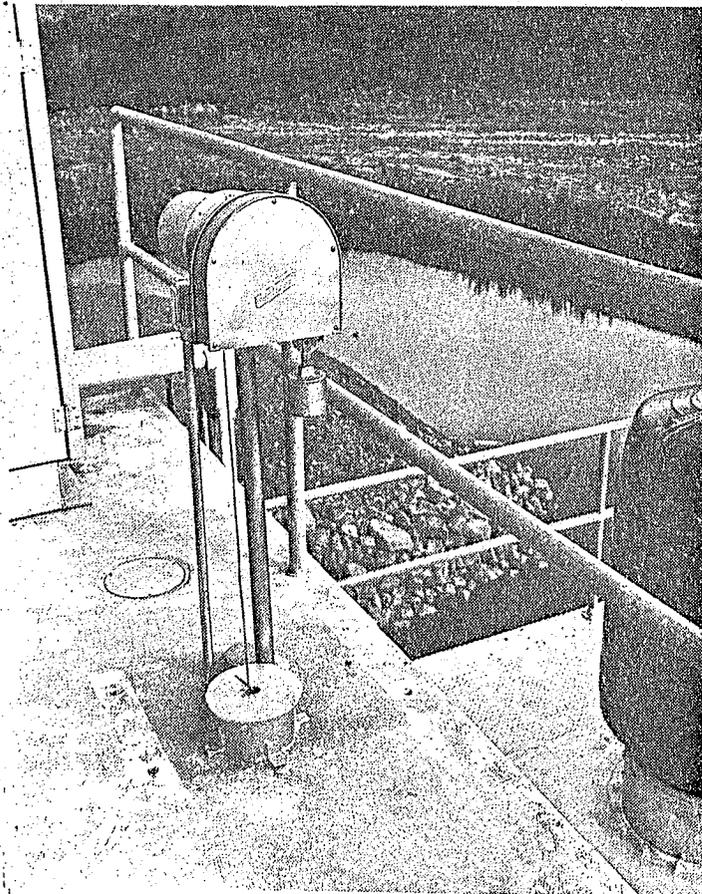
UPPER DECK OVER DISTRIBUTION BOX
BYPASS OUTLET SLIDE GATE CONTROL



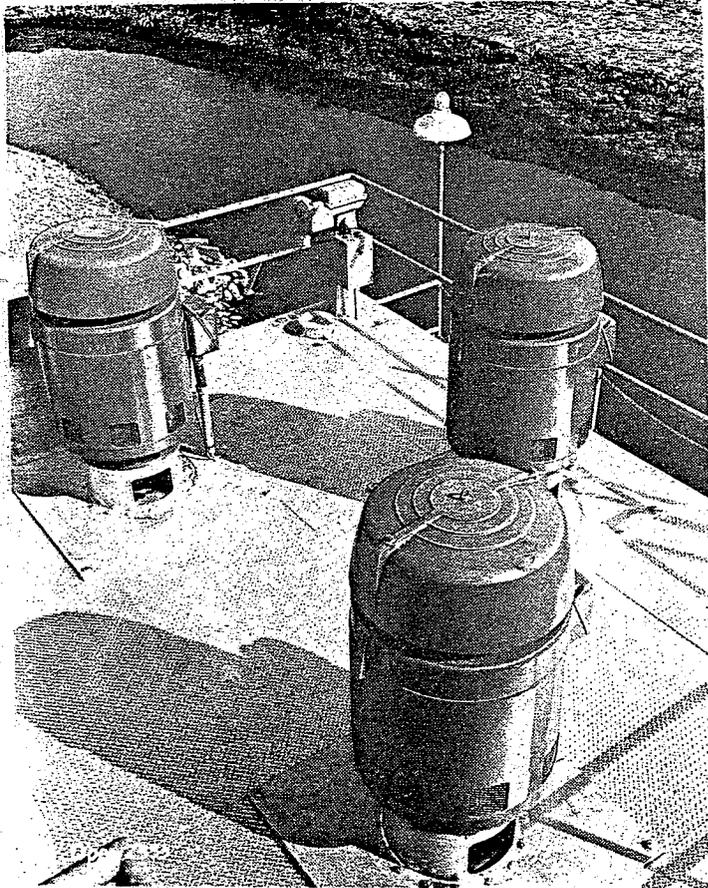
BYPASS INLET SLIDE GATE CONTROL



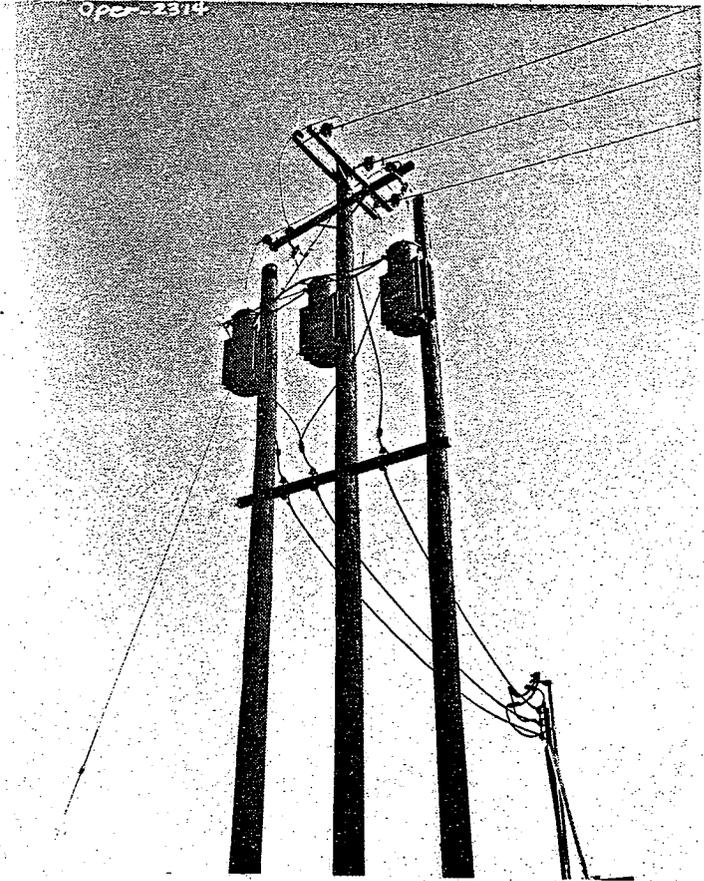
UPPER DECK OVER DISTRIBUTION BOX
(W.L. recorder cover removed)



AUTOMATIC FLOAT OPERATED RECORDER
W.L. IN DISTRIBUTION BOX



VIEW OF PUMPS FROM UPPER DECK



TRANSFORMER BANK INSTALLATION

EXHIBIT E

Letter of Acceptance by the State Reclamation Board

EXHIBIT E

C
O
P
Y

THE RECLAMATION BOARD

of the

STATE OF CALIFORNIA

September 26, 1960

C
O
P
Y

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

Dear Sir:

Reference is made to your letter of September 14, 1960, concerning the transfer to the State of the portion of the Middle Creek Project consisting of the Bloody Island Pumping Plant and appurtenant facilities.

The Reclamation Board, at its meeting of September 21, 1960, formally accepted this pumping plant for operation and maintenance.

Sincerely yours,

A. N. MURRAY /s/
General Manager and Chief Engineer

EXHIBIT E
Sheet 1 of 1

EXHIBIT F

Mechanical-Electric Equipment
Inspection Check List

EXHIBIT F

EXHIBIT F

Mechanical-Electrical Equipment

Inspection Check List

PROJECT: Middle Creek Pumping Plant

INSPECTOR: _____ DATE _____

<u>ITEM</u>	<u>**PERIOD EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT., & INITIAL</u>
1. <u>Drainage Pumps-Motor Units</u>			
a. Pumps (see sheet 7 of EXHIBIT D)			
(1) <u>Lubrication</u>			
Adequacy.			
Functioning of oiling system.			
Condition of lubrication lines fittings, pipe, anchors, etc.			
Adequacy of supply of lubricant on hand.			
(2) <u>Functioning of Pump</u>			
Smoothness of operation unusual vibration and or noise.	Each 8 hours*		
Pump RPM.	6 months		
Capacity.	6 months		
Drive shaft vibration when running.	day*		
Bearing wear	year		

*During periods of pumping operations.

**See paragraph 5-04 of this manual and note 4 of EXHIBIT F, sheet 8.

<u>ITEM</u>	<u>PERIOD EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT., & INITIAL</u>
(3) <u>Adjustment.</u>	year		
Check Adjustment (see Pump Manual)			
Miscellaneous.			
(4) <u>Condition of Pump</u>			
Bearings	year		
Drive shaft	year		
Drive shaft connections	year		
Grease packing rings	year		
(5) <u>Pump anchorage</u>	week		
(6) Debris in pumping pit around pump suction, etc.	day*		
(7) <u>Discharge line</u>			
Pipe couplings	month		
Flap gate	month		
(8) Condition of metal work	6 months		
(9) Miscellaneous			
b. Pump Motor			
(1) <u>Lubrication</u>			
Adequacy	day*		
Bearing temp. noise vibration etc.	day*		
Functioning of bearing feed oiler, and oil level.	day*		
Lubricant piping, fittings, reservoir, etc.	day*		
Note signs of oil leakage at any point	day*		

*During periods of pumping operations.

<u>ITEM</u>	<u>PERIOD</u> <u>EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT.,</u> <u>& INITIAL</u>
(2) <u>Motor Operation</u>			
Note any indication of excessive temperature rise under load.	day*		
Abnormal vibration and/or noise.	day*		
Check function of motor controls.	day*		
Note any failure of motors to pull in throughout the load range.	day*		
Inspect for moisture inside the motor housing.	month		
Motor base anchorage.	month		
(3) <u>Drive shaft & coupling</u>			
Inspect for functioning and condition.	month		
(4) Note accumulations of oil on or around the motor.	day*		
(5) <u>Metal Work</u>			
Note rust spots wear and condition of paints	6 months		
(6) <u>Spare Parts</u>			
Adequacy of supply.	3 months		

2. Electrical System.

a. Main Switch Board

- (1) Inspect all equipment and note need for cleaning. week

*During periods of pumping operations.

<u>ITEM</u>	<u>PERIOD</u> <u>EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT.,</u> <u>& INITIAL</u>
(2)	month	Check switches and controls to insure that they are mechanically operable.	
		(Note indications of sluggish operation or sparking.)	
(3)	day*	Note any instruments such as motors, recorders, etc., which are not registering properly.	
(4)	week	Check supply of recording charts and need for changing chart.	
(5)	day*	Inspect for indications of: Loose connections. Insulation deterioration. Unusual odors. Mechanical failures.	
(6)	day*	Report any failure of the controls to control the operation of the units for which they are intended.	
(7)	year	Inspect relays, etc., making full use of manufacturers descriptive data.	
(8)		<u>Circuit Breakers</u> Condition of oil. Condition of contacts. Functioning of the operating mechanism. Lubrication of pins and bushings.	

*During periods of pumping operations.

<u>ITEM</u>	<u>PERIOD</u> <u>EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT.,</u> <u>& INITIAL</u>
Tightness of bolts, nuts, cotters, etc.			
Evidence of heating.			
Condition of bushings.			
Miscellaneous.			
(9) <u>Starters</u>	month		
Check all connections.			
Check to insure that all moving parts move freely.			
Check adjustment and condition of contact tips.			
Check functioning of start and stop buttons and overload relay.			
Miscellaneous.			
(10) <u>Contactors</u>			
Check for proper functioning, including opening and closing operation.			
Inspect contacts.			
Check adjustment of contact gap.			
Check contact pressure.			
Miscellaneous.			
b. Miscellaneous			
(1) <u>Lighting System</u>			
Check light fixtures and controls for proper functioning.	week		

<u>ITEM</u>	<u>PERIOD EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT., & INITIAL</u>
Check adjustment of flood light.	month		
Inspect circuit breakers.	month		
Check supply of fuses and light bulbs on hand.	month		
(2) <u>Pump Motor Controls</u>			
Check the entire electric system provided for operating the main pumping units.	year		
(3) <u>Power Supply</u>			
Generally inspect the Power Co.'s transmission line installations in the vicinity of the pumping plant.	month		
3. <u>Trash Racks</u>			
Condition of metal work.	year		
Anchorage.	year		
Note debris in rack and pool that should be removed	day (during plant operation)		
4. <u>Gates and Hoists</u>			
a. Slide Gates	6 months		
(1) <u>Gates</u>			
Check condition of metal work, etc.			
Check anchor and connections for tightness and wear.			
Inspect seal bearing surfaces for condition and need for lubrication.			

<u>ITEM</u>	<u>PERIOD</u> <u>EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT.,</u> <u>& INITIAL</u>
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When practical check gate for adequacy of sealing when gate is closed.

Note any debris, etc., which may restrict free movement of the gate leaf.

(2) Hoist

Check for proper functioning.

Note need for lubrication cleaning, etc.

Inspect hoist stem guides, connections, etc., and note any need for maintenance.

Note condition of manhole covers and note failure to lock.

Check position of hoist stem to insure that gate is in position desired.

Note condition of all metal work, anchors, etc.

b. Flap Gates

Debris, etc. in or around inlet. day*

Condition of metal work. 6 months

Functioning during operation. day

Note any indication of leakage when closed. week

Miscellaneous.

*During periods of pumping operations.

<u>ITEM</u>	<u>PERIOD EVERY</u>	<u>REMARKS</u>	<u>DATE, MAINT., & INITIAL</u>
5. <u>Fire Protection Equipment</u>			
a. Check extinguishers.	month		
b. Note any possible fire hazards in and around the pumping plant and other installations.	day		
6. <u>Staff Gages</u>			
a. Condition of woodwork.			
b. Are all in place.			
c. Condition of painted surfaces.			
7. <u>Pumping Plant Structure</u>	year		
8. <u>Miscellaneous</u>			
a. Note need for policing the area around the pumping plant and other installations.	month		
b. <u>Painting</u> : Check all metal work and note rust spots need for painting or other maintenance.	year		
d. <u>Hazards</u> : Check all manhole covers to insure that they are in place.	month		
Determine adequacy of fencing and gate locks.			
Note any fire hazards - paint, oil, rags, paper, etc.			

NOTE:

1. The period indicated is to serve as a general guide. (More frequent inspections shall be made if operating experience and type of service for a particular period justifies.)
2. Under "Remarks" briefly indicate maintenance, adjustment, etc., required.
3. When required maintenance etc., has been completed, indicate date and initial.
4. Daily inspections are applicable only to periods of pumping operations; and when pumps are operating continuously during flood conditions should be made at least once every 8-hour shift. See also requirements set forth in para. 208.10(f) of Federal Regulations, EXHIBIT "A" of this manual.

EXHIBIT G

Mechanical-Electrical Equipment

Lubrication Schedule

EXHIBIT G

EXHIBIT G

Mechanical-Electrical Equipment

Lubrication Schedule

PROJECT: Middle Creek Pumping Plant

<u>Item</u>	<u>Lubricant</u>	<u>Period Every</u> (During pumping operations)
1. <u>Main Pump-Motor Units</u>		
a. Pumps		
(1) <u>Drainage Pumps</u>		
Pump bearings.	<u>Oil</u> : SAE 10 oil (non detergent)	Check daily; add as required.
	<u>Grease</u> : RPM Chassis Grease T-B Medium, Standard Oil Co. or approved equal.	Check twice daily; add as required.
b. Main Pump Motor	<u>Oil</u> : Calol Turbine No. 11 or 15.	Check daily; add as required.
	<u>Grease</u> : Calol BRB-340.	Check daily; add as required.
2. <u>Electrical System</u>		
a. Miscellaneous		
(1) <u>Motor Bearings</u> :		Check daily .
Ball or roller.	Calol BRB-340	6 months Check daily .
(2) Switches general .	Tranoil Oil .	Monthly
(3) Switch-hinge pins .	Tranoil Oil with graphite .	Monthly
(4) Relays .	General Electric Co. special relay oil .	6 months

<u>Item</u>	<u>Lubricant</u>	<u>Period Every</u> (During pumping operations)
(5) Rheostat contacts.	Light coat of vaseline.	After cleaning and dressing.
(6) Instrument, reorders, etc.	Mfgrs. recommendations	Mfgrs. recommendations.
(7) Push-button contacts.	Petroleum.	6 months
(8) Cleaning solvent Note: When cleaning any part of electrical equipment, use ample precaution to prevent explosions & fires.	"Stoddard solvent, or a mixture of carbon tetrachloride and petroleum".	6 months

3. Trash Racks

4. Gates and Hoists

Slide Gates

(1) Gates

Seal bearing surfaces.	Calol WP No. 1 Grease.	6 months
Miscellaneous	Rust preventative NO-OX-ID, Type E.	6 months

(2) Hoist

Screw.	Calol WP No. 1
Stem.	" "
Pressure fittings	" "
*Open gears	" "

*If grease applied to exposed gears and/or screw is found to be objectionable from the standpoint of accumulation of dirt lubricate with light oil before operating.

5. Flap Gates

Hinge	Calol WP No. 1	Apply to pin when assembling and coat outside after assembly.
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6. General Notes.

a. There are many lubricants suitable for service as pertain to the above items of equipment. The trade names indicated above are listed as being representative; any equivalent lubricant may be used.

b. Manufacture of lubricants specified above.

- (1) UNO - Union Oil Co.
- (2) NO-OX-ID Dearborn Chemical Co.
- (3) Calol - Standard Oil Co. of California.
- (4) Trancoil - General Electric Co.
Special oil for electrical equipment.
- (5) RPM - Standard Oil Co. of California.
- (6) "Stop-Rust" - The Delta Mfg. Co., Milwaukee, Wisconsin.
- (7) Stoddard Solvent - Described in U. S. Bureau of Standards as "Commercial Standard GS-3-28."

c. Electrical equipment shall be lubricated only where recommended by the equipment manufacturers or in accordance with best accepted practice for the service. Where lubrication is required, lubricate adequately but sparingly, wiping off any excess lubricant, as oily surfaces collect dust and may result in an arc between live parts.

d. The above schedule is provided as a general guide in the absence of specific recommendations from the manufacturer of the respective items of equipment. Use only the best grades of lubricants and of the type and in accordance with the manufacturer's recommendation where available. When in doubt consult with one of the manufacturers of lubricants suitable for the service.

EXHIBIT H

Sample Log for Recording and
Reporting Operation of Pumping
Plant During Flood Period

EXHIBIT H

OPERATION OF AUXILIARY EQUIPMENT
AND
MISCELLANEOUS PLANT FACILITIES
DURING FLOOD PERIOD

DATE: _____

PERIOD: _____

SUPERINTENDENT: _____

Item No.	Description	Time	Remarks*
1	Pump controller and indicator in Pump Well "A"		
2	Automatic float operated water level recorder in distribution box		
3	Main switch board		
4	Flapgates in pump discharge lines		
5	By-pass outlet gates		
6	By-pass inlet gates		
7	Trash racks		
8	Slide gates in discharge conduits		
9	Power supply		
10	Lighting		
11	Miscellaneous		

EXHIBIT H
Sheet 2 of 4

*Brief note under Remarks and reference to more detailed comments on an attached sheet with appropriate cross references. See EXHIBITS D, F, and G for a guide as to breakdown of the respective items checked. Note in particular any abnormal noise, malfunctioning of equipment or any condition that develops that may or does impair the operation of the plant or unit thereof.

